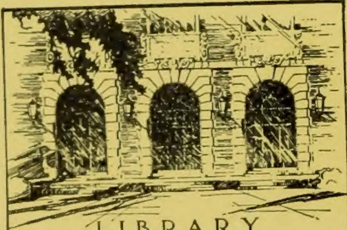


LIBRARY
OF THE
UNIVERSITY
OF ILLINOIS
629.1305
FLYS
v.11-13

Return this book on or before the
Latest Date stamped below.
Theft, mutilation, and underlining of books
are reasons for disciplinary action and may
result in dismissal from the University.
University of Illinois Library

JUL 16 1964

L161—O-1096

629.1305
FLYS
v.11-13

ages 2 to 13, inclusive, are devoted to discussions f flight characteristics of the F-94C, the F-89D, the -84F and the F-86F, written by veteran test pilots.

• • • • •

Aimed at You . . . .

This volume is bound without ____________

Vol. 11, No. 5 (May 1955)

which [redacted]. was never published.

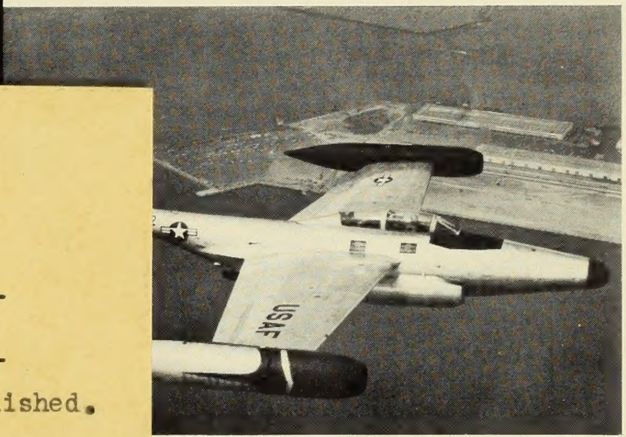
[illegible] perational problems of jet aircraft, especially by ilots transitioning to jets.

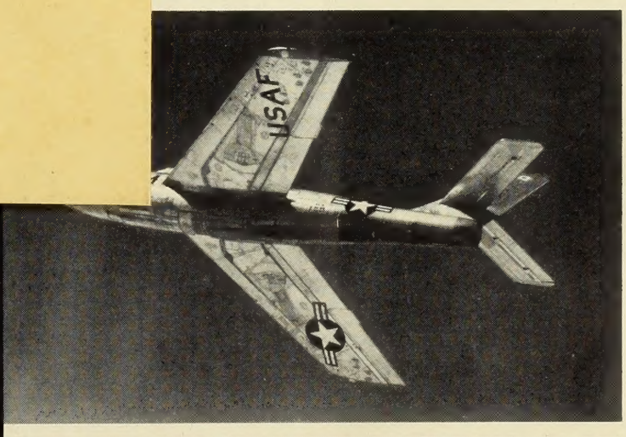
All in all, it can be said that there is no time for ay dreaming when you are hustling through the lue in a jet aircraft.

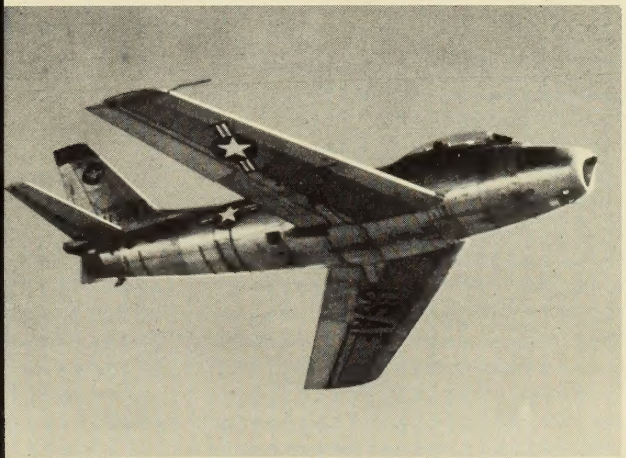
This month FLYING SAFETY is presenting Part II f its annual all jet issue. An effort has been made to nclude material on specific aircraft and some of their pecial operational phases, as well as general infor- ation on jet flying. The articles contained herein ere selected after careful screening and editing and re directed specifically at you, the jet pilot.

★ ★ ★ ★

Next month the greater portion of FLYING SAFETY ill be devoted to new, up-to-date information on eciprocating powered aircraft. Our lead article should e of great interest to all C-124 pilots, in particular.







629.1305
FLYS
v.11-13

ges 2 to 13, inclusive, are devoted to discussions flight characteristics of the F-94C, the F-89D, the 84F and the F-86F, written by veteran test pilots.

• • • •

Aimed at You . . . .

How many times have you heard this phrase? lying is not inherently dangerous, but like the a it is terribly unforgiving." Even in this age of ght that lies somewhere between the old "seat of e pants" flying and fully automatic flight, this dage still holds true.

The basic principles as applied to reciprocating gines still apply to jets. They are just more critical. om preflight planning through cruise control and nding, jet flying leaves less margin for error.

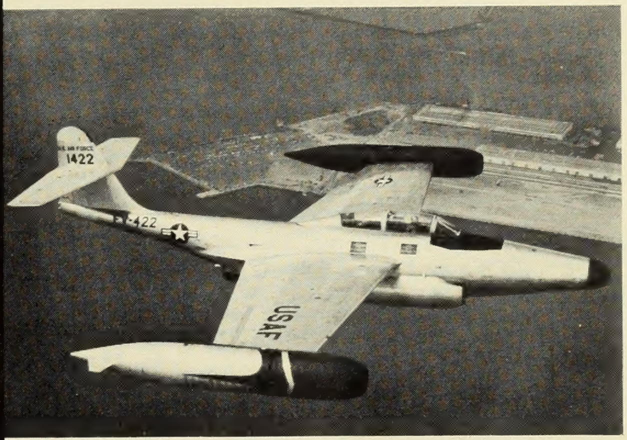
High speed and fuel consumption are the two asic differences between flying the jet and the re- procating powered aircraft. With the increased eed, you are required to think faster in order to ay ahead of the plane. With the high rate of fuel nsumption, you are required to plan your flight uch more carefully. These two basic differences are metimes forgotten or minimized in coping with the erational problems of jet aircraft, especially by lots transitioning to jets.

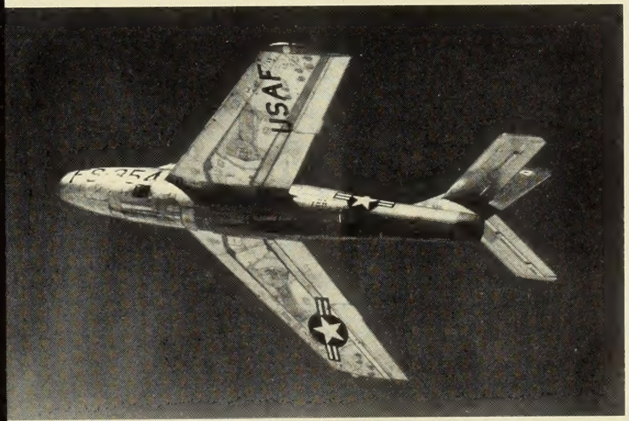
All in all, it can be said that there is no time for ay dreaming when you are hustling through the ue in a jet aircraft.

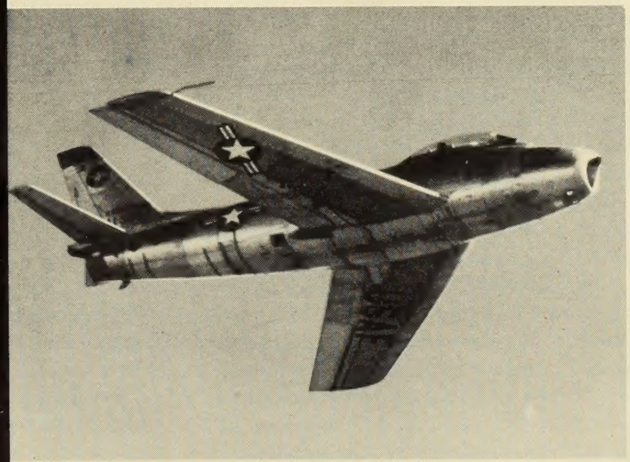
This month FLYING SAFETY is presenting Part II f its annual all jet issue. An effort has been made to clude material on specific aircraft and some of their ecial operational phases, as well as general infor- ation on jet flying. The articles contained herein ere selected after careful screening and editing and e directed specifically at you, the jet pilot.

★ ★ ★ ★

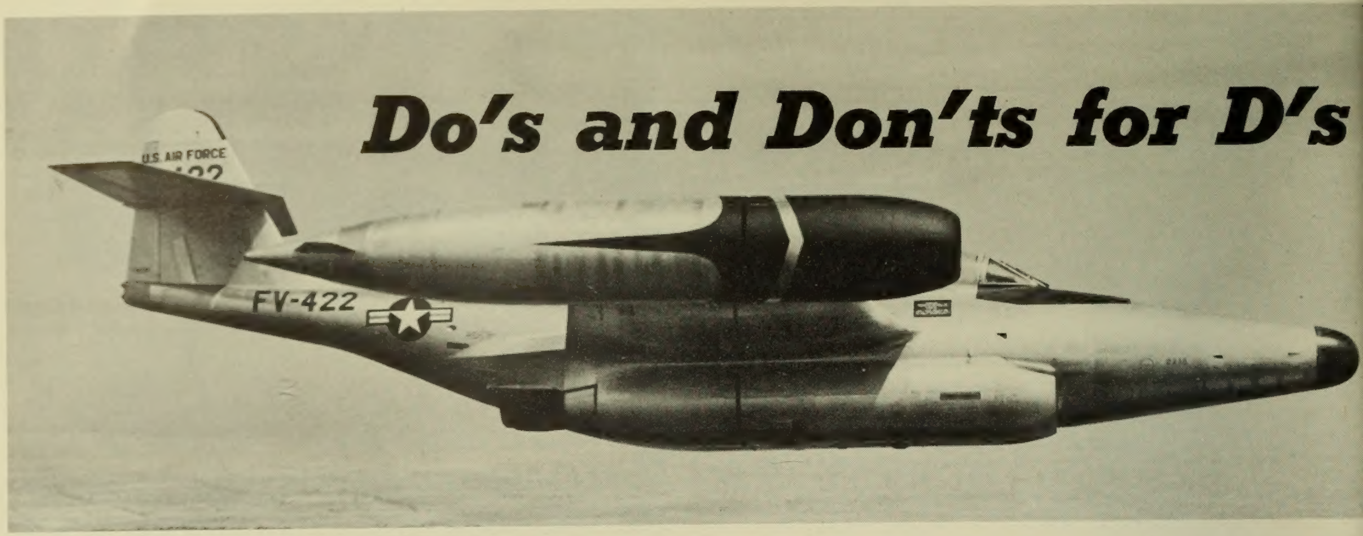
Next month the greater portion of FLYING SAFETY ill be devoted to new, up-to-date information on eciprocating powered aircraft. Our lead article should e of great interest to all C-124 pilots, in particular.







Do's and Don'ts for D's



By Lewis A. Nelson, Supervisor of Experimental Test Pilots, Northrop Aircraft Inc.

SOMETIMES engineering test pilots must conduct tests under flight conditions prohibited to the operational pilot for one reason or another. As a result, the test pilot requires certain first hand knowledge that is not always found in flight handbooks. You might call this supplementary flight experience.

As one of the pilots assigned to engineering flight tests of the F-89D airplane, I have been exposed to some supplementary flight experience that has convinced me thoroughly of the structural integrity of the Scorpion for all aircraft loading and flight conditions. I also have been there when this airplane demonstrated its stability and control characteristics. Sometimes I've been privileged to be the first witness of this sort of thing on the Scorpion.

That's why I have a special pride in this big, husky fighter.

Flight characteristics may be best discussed by considering low speed handling qualities, spins, high Mach and high altitude flight.

Low Speed Handling

The Scorpion is an easy airplane to fly. It is completely honest approaching and in the stall. Normal wing heaviness and slight buffet occur prior to stall which is "straight-ahead." This holds at all altitudes, from sea level to 45,000 feet plus. Similarly, accelerated stalls are mild and straight through. Extension of gear, flaps or speed brakes causes no change in stall characteristics, only in stalling speed.

Slow speed flight characteristics make it ideally suited for its role as an all-weather "bomber-knocker-downer." Use of speed brakes during instrument approach provides go-around potential approaching that of prop types since acceleration is immediate as speed brakes close. Trim changes are negligible with use of gear, flaps or speed brakes. Response to aileron deflection is slow at low speeds due to reduction in aileron effectiveness at high angles of attack, and the high tip pod weight of Ds makes this more apparent than on previous models, but control at normal approach speeds is more than adequate. Tests have shown that it is possible to land normally with one tip full and one empty. Little reserve control remains in this condition so it is strongly recommended, as outlined in pilot operating instructions, that tip fuel be dumped prior to landing if one fails to feed.

Spin Test Results

Spin tests on the F-89D have not been completed at this writing. However, spin recovery tests performed on the F-89C have shown it to be unwilling to spin. It is necessary to hold full up elevator and full rudder in the desired direction of rotation to induce and maintain the spin.

The Scorpion is the heaviest airplane ever to go through spin tests.

Spin tests on the F-89C were conducted under a wide variety of flight conditions. Spins and recoveries were made with varying configurations of control surfaces, with engines idling and with power on, with the aircraft in clean flight condition and with landing gear and flaps extended, and with varying fuel loads and center-of-gravity positions.

During these tests it was determined that aileron position had no adverse effect on recovery characteristics. Power-on spins resulted in steeper entry and apparently faster rotation. Power effect produced a steep recovery, but did not adversely affect stopping the rotation. Landing configuration spins were flatter and slower than those when "clean."

Altitude loss during spins was about 3000 feet per turn, with recovery after rotation stopped requiring 1000 to 3000 feet, depending on pitch attitude at start of recovery.

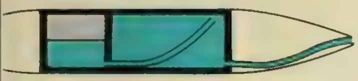
The general conclusion drawn from spin tests was that the Scorpion has no dangerous inherent spinning tendencies and has excellent spin recovery characteristics. Conventional recovery techniques are entirely satisfactory; that is, full rudder opposite to the direction of spin, followed by forward stick will stop the spin quickly Slight aileron movement opposite to the direction of spin adds appreciably to the speed of recovery.

High Indicated Airspeeds

High speed characteristics of the F-89D are quite similar to other high

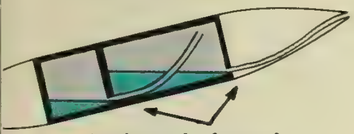
Tip Tank Dumping

Normal Operation



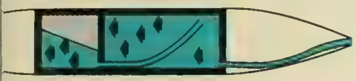
ormal dumping should be in level ight or climb. Time required to mpty full tanks (engines at 100%) 60 sec. Cycle completed in 75 sec.

Fuel Dumped in Dive



tip tanks are dumped in steep ives, fuel outlet ports may be unvered by fuel shifting in tanks, sulting in incomplete dumping.

Fuel Dumped Decelerating With Speed Brakes



dumping is initiated during decelation with speed brakes, a second mping cycle may be required to npty tanks completely.

pproximately 0.3G back pressure e to deceleration forces.

nd: Fuel 🟦 Compressed Air

ARNING: During takeoff and imbout, don't initiate dumping uns you're sure that you can stay irborne until tanks are empty.

erformance airplanes. It is possible o exceed the structural design limits f excessive control deflection is used t the high indicated speeds possible t low altitude. These characteristics re discussed in every Pilots' Handook so will not be repeated here. However, a phenomenon was ob-erved during low altitude high speed ests that a pilot should have knowl-dge of to prevent "panic-button ushing." Normal fuel sequencing on arly F-89s reduced the fuel weight at the tiptanks early in the flight before it reached high speeds.

The addition of pylon tanks to early models and rocket-fuel pods and pylon tanks to the "Ds" made it possible to reach placard speeds with heavier pod weights; consequently, this configuration was tested to maximum speed at low altitude as part of routine flutter tests. During these tests it was found that the wing had a tendency for bending oscillations often in turbulent air at or above limit indicated airspeeds at low altitude. As a result a thorough investigation and analysis was made which ascertained that this wing damping was definitely damped out at all times. Normally the pilot should not encounter this phenomenon; but if it does occur, all that need be done is to reduce speed slightly by reduction of throttles or by pulling up.

Another important characteristic investigated during early tests was that of elevator power limit or, as it is sometimes called, reduction of elevator effectiveness with increasing Mach above 0.8. This loss due to high Mach compressibility effects is aggravated by high dynamic forces developed at high speed at lower altitudes. All trailing edge controls suffer in this manner, but only the elevator will be discussed here.

The loss of elevator power is most critical during dive recovery because of reduced ability to pull G for pullouts. This data presented in the Pilots' Handbook should be studied carefully, since it graphically illustrates the many factors affecting dive recovery. The data presented has been flight tested, and values are for stabilized conditions. It is suggested that a "cushion" be left for inaccuracies in judging dive angle and lag in instrument readings. This holds for any airplane type but is more critical for aircraft which have elevator power limits which prevent increasing pullout load factor. Study your dive recovery charts and approach their limits cautiously. Power reduction and speed brakes both help in the recovery.

High Mach Characteristics

High performance aircraft commonly exhibit some undesirable characteristics. A whole new language describes the deficiencies found in this flight regime: 1 G buffet, rudder shift or yaw, wing drop, aileron buzz, tucking and pitchup.

At this time it seems appropriate to restate my feelings that the '89 is an "honest" airplane, affected only a little at high Mach numbers. This may be shown best by examining the high Mach characteristics of the Scorpion in the order of their occurrence as speed is increased.

The first indication of transonic characteristics occurs as speed approaches maximum speed in level flight. This is manifest as a mild reversal in static stability gradient or, as often described, "tucking." Actually tuck is not too descriptive in this case since this reversal, while quite abrupt, is not dangerous in any sense. Only slight increase in back pressure is required to maintain level flight as speed increases. This region is also restricted in Mach span and usually goes unnoticed in rapidly changing speed conditions such as might occur in a dive, with the pilot instinctively correcting for the change.

Beyond maximum speed in level flight, 1 G buffet develops. This is not of sufficient intensity to affect the tactical worth of the bird. Shortly after buffet onset, noticeable wing heaviness develops with the airplane "clean." This usually occurs to the left but has been experienced to the right as well. This variation from one aircraft to another is the result of manufacturing tolerances, asymmetrical trim, etc. Ailerons, being trailing edge controls, suffer the same loss in effectiveness as do the elevators, so considerable stick displacement is necessary to maintain wings level attitude. The incorporation of split ailerons for use as speed brakes (decelerons) makes it possible to eliminate this normally troublesome transonic characteristic. Partial opening of decelerons (approximately 5-10 degrees) restores effectiveness of the ailerons almost completely. This may be shown best by diving the Scorpion with decelerons closed and holding wings level with the ailerons. Once approximately two-thirds of stick displacement has been reached, opening speed brakes slightly results in a tendency to roll abruptly in the direction of stick displacement as aileron effectiveness is restored. The best way is to crack brakes prior to roll-off, thus preventing loss of aileron effectiveness.

It is interesting also to note that this small opening of speed brakes at high Mach does not increase drag but actually reduces it as will be discussed under high altitude characteristics. As Mach is increased over that where roll-off would occur the buffet intensity decreases, finally disappearing entirely as flow conditions about the aircraft stabilize and local airflow becomes supersonic and stability increases. No further change in flight characteristics occurs with increase in speed beyond this point, the bird being very solid. Return through the region just described during pullouts poses no problem, simply being the reverse sequence.

High Altitude Flight

The increase in airplane speed and altitude performance made possible by the many improved engine designs has opened a new region of problems.

Not too long ago angels 40 was our goal; now it is 50 with one eye on 60. With each increase in altitude the problem of just keeping the bird flying becomes more acute. Add to this the requirements of maneuvering to close in for a "kill" and you really have a problem.

Tests that I have made have indicated to me that extension of a few degrees flaps improves altitude performance. The reason for this is quite simple; indicated airspeed for a given Mach number is reduced considerably from that of low altitudes, i.e., to fly at 0.90 Mach, one would indicate 410 knots at 20,000 feet, but for the same Mach at 50,000 feet indicated would be only 200 knots. It is upon this indicated speed (dynamic pressure) that the airplane depends for developing lift to sustain flight. As you know, if indicated airspeed is reduced the angle of attack must be increased to maintain altitude.

Also, sad but true, is the fact that in level flight as angle of attack is increased, drag is increased. Thus starts the vicious circle, speed decrease requires increase in angle of attack which results in increased drag and accompanying further decrease in airspeed — and around we go.

Discussion thus far has assumed a constant airfoil section (clean); however, flaps also change the lift developed by the wing. For a given angle of attack and airspeed, lift is increased as flaps are extended. Drag of the airfoil is also increased, so the lift increase isn't for free. While the use of flaps *increases* the drag of the wing at the same time lift is increased, the total drag of the airplane decreases since the fuselage angle of attack reduces this component's drag more rapidly than flap extension increases wing drag. Of course, there is a limit to this, approximately seven and one-half degrees flap seems to be the optimum to date. Don't expect the bird to leap from under you. We are talking about small numbers, a few knots at best.

The gain from use of flaps will be much more noticeable in another way which is just as important, if not more so, than the slight increase in speed. You gain up to 50 per cent in available maneuvering load factor. A solid aircraft above 45,000 feet—no "sinking" feeling in the turns.

The low indicated speed that is the source of our altitude problem has one advantage—flaps may be used at high Mach number without structural beef up. I use caution not to forget I have 'em down and split "S" out. Above 40,000 feet you are okay if you have seven and one-half degrees or less. There is no need for ever using more. I force myself to remember the flap placard speeds published in the Pilots' Handbook.

I also like this flap setting above 40,000 feet to improve the "feel." A few degrees will cause the aircraft to feel much more solid in the climb above this altitude. After you level off, flaps may be increased to seven and one-half degrees as speed increases. Exact angle is not too critical, feel is as good a criterion as any.

Speed brakes aid in much the same manner as landing flaps but to much less a degree.

Emergency Flight Controls

No discussion of airplane handling characteristics would be complete if the control system itself were not defined. This is especially true for full power control systems having artificial feel. F-89 type, that is. The pilot's ability to handle an emergency comes with experience and is aided by his knowledge of his airplane's characteristics and limitations.

Recent tests have shown the Scorpion flight control system to be extremely reliable. Briefly describing the tests seems to be the most obvious way to present this important information. For simplification, only the three major conditions tested will be discussed: full (3000 psi) pressure in only one of the two independent systems; emergency pressure (1500 psi R. H. system) only, and with one windmilling engine supplying pressure. These tests were made on a test aircraft having special shut-off valves for normal systems, so that the configurations mentioned previously and combinations thereof could be thoroughly investigated.

Little difference normally will be noted with only one full pressure hydraulic system available. This holds for flight at maximum speed level flight down to stall-in landing configuration. With only one system operative, the load factor available at limiting elevator power is reduced by approximately 0.3G.

Full basic control is possible with only the 1500 psi emergency system. The emergency pump's capacity is sufficient to maintain pressure during fast actuation of controls such as might be necessary during flight in turbulent air.

If the only pressure available to the control system is that from one windmilling (12-20 per cent rpm) engine pump, a safe landing is still possible. However, it would be necessary for the pilot to exercise caution in the rate of control movement to maintain at least 800 psi in the system. In other words, keep contro movements to a minimum and avoi rapid application of either stick o rudder. This pressure is considere the minimum desirable since dange of dumping all remaining syster pressure exists if the purge valv actuates (500-600 psi). Once thi valve operates, the windmilling engine will be unable to develop suff cient pressure to close the valve, an the system is lost. The hydraulic pum replenishing rate at windmilling spee is low. Obviously this latter case i extreme, but it serves to illustrat the margin of control available caution is used in control movemen

Excluding battle damage, the mo critical condition conceivable woul be loss of both engines as a resu of fuel starvation. In the event th occurred it would be advisable to u windmilling engines only as hydra lic pressure source during descent save the electric emergency pump f added safety during landing.

In this article, I have attempted accomplish one purpose — to discu the flight and handling characteristi of the Scorpion F-89. The best "se ing point" for you is to have a litt time in the airplane under oper tional conditions. It was designed a built for a purpose and is fully al to fulfill its mission. As I mention previously, it is an easy, "hones airplane to fly. ●

the C AROUND YOU

Sammy Mason, Flight Test Pilot
Lockheed Aircraft Corp.

WHEN I was first asked by FLYING SAFETY to do a story on spinning the F-94C, I wondered what there was to tell. After all, I reasoned, the Pilot's Operating Instructions cover the subject adequately, and I was sure the magazine didn't want a rehash of the Dash One. Still, the Directorate of Flight Safety Research had asked that the spin characteristics of the "C" be analyzed, so there must be a reason behind such a request.

You know, it's funny how many angles a man will come up with when thinking seriously on any given subject. The more I thought about spins in the F-94C, and the more I reviewed the Operating Instructions, the more I realized that although the manual is complete insofar as basic principles are concerned, there are still some fine points that are well worth considering.

About the only way I can lead into a piece like this is to discuss some typical spins. After riding through several hundred in any one type of aircraft, they become almost commonplace, but still, I'm of the school that believes every flight and every maneuver will teach something new, so let's run over some typical spins in the F-94C.

I don't care whether you're going to fly a Maytag Messerschmitt or a Starfire, the first thing you must do is to complete a thorough preflight check of the plane and make certain that all loose objects are tied down in the cockpit. This is especially vital when you are planning any acrobatic maneuvers, including spins.

We've all had our share of odds and ends flying around the office unexpectedly, such as bucking bars and wrenches, and it just isn't fun. So—I say again—make that preflight check complete and thorough.

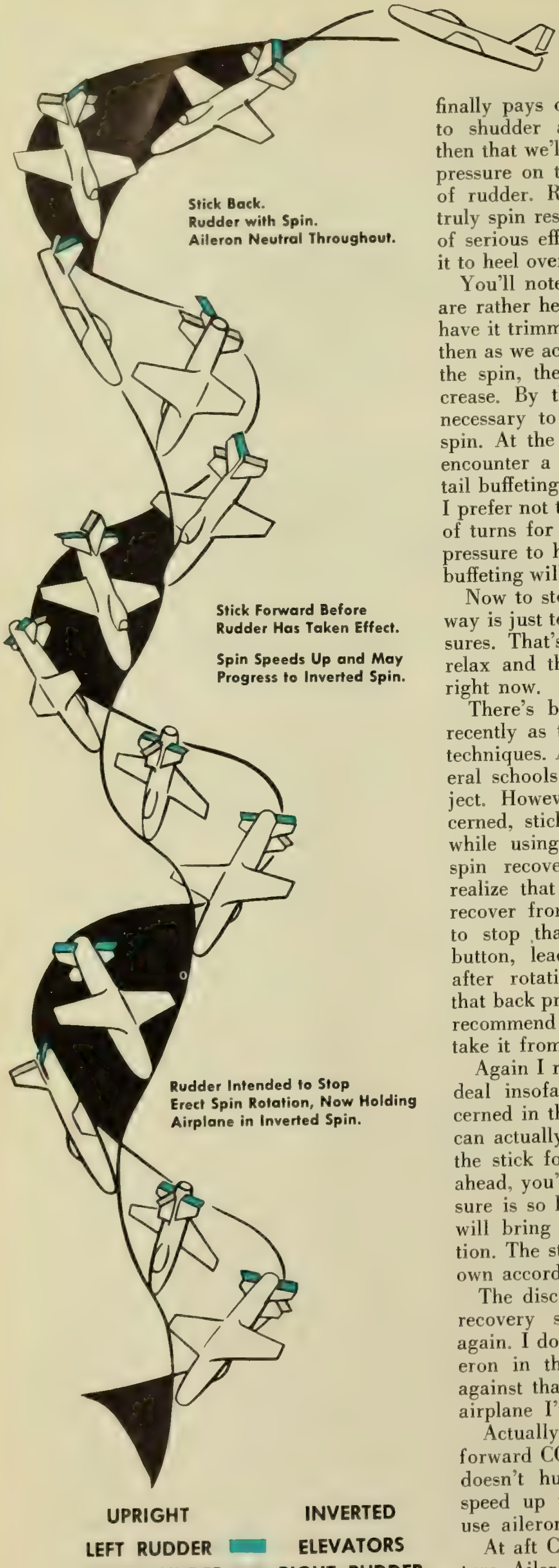
Okay, so we've completed our ground checks, fired up the plane and have climbed upstairs to about 25,000 feet. Everything is going along fine, and we're ready to perform some spins.

First things being first, we clean up the cockpit, trim the plane for level flight and then clear the area carefully. Remember how your instructor taught you to roll that old PT around before you started any acrobatics? You made certain that you had plenty of air around you that was not cluttered up with other airplanes. This is a two-way proposition. You don't want to spin into some poor unsuspecting soul, and by the same token, you could get a bit irritated if someone came clobbering into your cockpit. So, clear the area carefully.

Now, let's put our F-94C into a normal entry, spin it and recover. Believe me, it's a simple maneuver and I feel you're going to enjoy it.

We'll make this first one nice and clean. Let's check. Gear, flaps and dive flaps all tucked in? Okay, now throttle back to IDLE and pull the nose up slightly. Like any jet, the plane seems slow in decelerating but as the speed falls off we start easing the nose up, even more. Nothing extreme, mind you, just a clean stall.

The "C" is a kindly aircraft and gives you a lot of warning before it



finally pays off. You'll feel it begin to shudder a little, and it's right then that we'll feed in plenty of back pressure on the stick and apply lots of rudder. Remember, this baby is truly spin resistant, and it takes a bit of serious effort on your part to get it to heel over and slip into that spin.

You'll note that the rudder forces are rather heavy, especially when we have it trimmed for forward CG, and then as we actually get winding up in the spin, the control forces will increase. By that I mean, the forces necessary to hold the plane in the spin. At the same time we begin to encounter a lot of buffeting, mostly tail buffeting. With that forward CG, I prefer not to wind up over a couple of turns for it takes a lot of control pressure to hold her in the spin, and buffeting will increase.

Now to stop it. One easy and sure way is just to release all control pressures. That's all there is to it. You relax and the plane stops spinning, right now.

There's been a lot of discussion recently as to various spin recovery techniques. Apparently there are several schools of thought on this subject. However, as far as I'm concerned, stick full back is important while using the rudder to effect a spin recovery. Understand now, I realize that any good airplane will recover from a spin unassisted, but to stop that rotation right on the button, lead with the rudder, and after rotation has stopped, release that back pressure. The NACA people recommend this procedure too, and take it from me, it works nicely.

Again I repeat, trim means a great deal insofar as recoveries are concerned in the '94C. With aft CG you can actually hurry things by pushing the stick forward, but with CG trim ahead, you'll find that the back pressure is so heavy, merely releasing it will bring about a responsive reaction. The stick will pop ahead on its own accord if you give it a chance.

The discussion of ailerons in spin recovery still crops up now and again. I do not recommend using aileron in this airplane, in fact, I'm against that practice in almost every airplane I've ever flown.

Actually, in the F-94C, with a forward CG condition, use of aileron doesn't hurt anything, but it may speed up the rotation a bit if you use aileron with the spin.

At aft CG we have a different picture. Aileron control against the spin has a tendency to flatten it out a lot and will louse up the rudder and elevator control a great deal. Then too, if you get a spin stopped while still holding in aileron pressure, the chances are good that the ship will flop and spin in the opposite direction. So remember, when you have an aft CG condition, keep the ailerons in the neutral position.

Actually, in discussing forward and aft CG positions, I am trying to brief you on any possible spin condition you might encounter. Normally, the only time most pilots will fly the F-94C in an aft CG condition is after the nose rockets have been fired. If no rockets are carried, ballast or dummy rockets are installed to maintain a forward CG position.

Here's another good thing to remember—and, this applies to most aircraft, especially if the CG is aft. If you are a bit early on the stick when affecting a spin recovery and haven't given the rudder time to take hold and stop the rotation, then you are very likely to experience a momentary speed-up in rotation. This can be disconcerting to a new pilot and has probably led to some premature ejections.

Just to prove my point, I've deliberately cranked the F-94C into a spin and then pushed the stick clear forward while continuing to hold hard rudder with the spin. The plane begins to revolve like the well-known button and there is no indication o a recovery. She just keeps on boring around. Some airplanes will get rea nasty under these conditions, but fortunately that does not apply to thi one. All you have to do for recover is pull the stick way back, feed i opposite rudder, and *after* it take effect ease the stick forward.

You've all heard of getting out o phase in handling controls. Well that can happen in a spin recover attempt. You yank, pull, push, pani and eject! 'Tain't necessary. Just ge back in phase again. Remember, fee in opposite rudder to the direction o rotation and keep the stick back. Rotation will stop. Then release bac pressure for a normal spin recover

Now here's another point to remember which applies to any we designed airplane. If you get in spin with full tips and the CG is we aft, and all of a sudden get in suc a hurry to stop the spin that yo leave opposite rudder poked in, wel in all probability, the plane will sto spinning, pause for a second or tw and then flop the other way. Maybe you'll say that's elementary stuff, and you're right. But, I've known some real sharp guys that forgot elementary stuff.

You're probably wondering how long it takes for the "C" to stop spinning under normal conditions and in clean configuration after recovery control pressure is applied. That's an easy one. Allow about one-eighth of a turn and you'll be right.

If you decide to wind up this plane with a lot of garbage out, such as gear and flaps, about the only real difference you'll note is the increased oscillation; the aircraft oscillates toward the horizon on the average of once per turn. This is especially true if you make your entry into the spin on the fast side.

On the first turn the nose will tend to come up pretty high and then as you progress into the spin, a dampening effect occurs and every turn will find the nose lower. Of course, center of gravity enters into the picture too. The further aft the CG, the higher the nose will ride for a while. In spite of this, recovery is the same as any spin and just as rapid. With dive brakes out, rudder is not quite so effective.

Maybe you're wondering about the altitude loss in a spin. Octually that depends on configuration and altitude upon entry. At 25,000 feet, for example, with all the garbage in, you'll lose about 5000 feet or so in a two turn spin. This includes recovery. With gear and flaps extended you'll actually rotate faster, and consequently the altitude loss per turn will be less. At lower altitudes, say from 15,000 or thereabouts, the loss is almost cut in half.

I guess it's the same old question, but someone always inquires about flat spins. Does the F-94C tend to get into flat spins? My answer is an emphatic *no*. I've been able to force a flattening effect by crossing controls but the bird won't stay there long, so we can scratch that problem. It doesn't exist.

On the subject of asymmetrical configuration as related to spins, my advice on the F-94C is the same as with any airplane with an uneven wingtip loading. Don't spin 'em. If you do accidentally and recovery is not effected within a turn or two—drop the tanks.

When I first started to get my ideas on paper, I didn't intend to get into the subject of inverted spins. My reason for thinking this way was because the F-94C makes the same kind of an inverted spin as any other good airplane. However, the more I thought about that subject, the more convinced I became that a few tips might be extremely valuable to a new pilot. For, although inverted spins are a prohibited maneuver in the 94C, sometimes a pilot enters one inadvertently. Even if only one of you new boys gets some help from the following ideas, it will be worth covering this subject.

For the experienced pilot I do not feel that the inverted spin presents any particular problem provided he initiates recovery upon recognizing it as such. The '94C does have a control reversal, similar to many other airplanes. You can work the stick up to a certain point where it will become neutral or negative. Then it'll want to go forward on you. At that point watch out. The airplane will continue to spin even after pressure has been released. Recovery is sluggish and it is possible that you could aggravate the situation until an uncontrollable condition developed.

Until a pilot has experienced an inverted spin, he'll probably be a bit leery of it. When the first one occurs you may wonder which rudder to use for recovery, which way the plane is rotating and so on. Actually, there's not much to it.

The best advice for the beginner is to forget whether the plane is spinning right or left. Merely push rudder against the way the plane *appears* to be turning and hold the stick back in your tummy! If the spin has not been prolonged or aggravated that will stop it, but fast.

You've always got to consider the possibility of slopping into an inverted spin from some acrobatic maneuver, such as stalling out on top of an Immelmann. Fortunately, the F-94C is just as spin resistant on its back as right side up, and here again you've got to work to make it spin, either side up.

Here's another thought to tuck away for future reference: *If you ever get into an inverted spin, you can recognize it at once because both your hands and feet will be pulling away from the controls.*

Incidentally, that is why I feel that although this business of holding the stick back while using recovery rudder in a spin may have been overstressed somewhat, it's still good business. Figure it out. Right side up or inverted, if you can just kick rudder against the apparent direction of rotation, the spin will stop and you can then complete the recovery from either type of spin, as the case may be. I say this because sometimes normal spins, in some planes, can get violent enough to fool the embryo pilot. I don't feel that this latter statement applies to the F-94C, but it's worth remembering.

That's about all I have to offer on inverted spins except this: Unless a new pilot has a few demonstrated while in flying school, the chances are good that he'll not recognize the fact when he suddenly goes from a right side up to an inverted spin. Here's the reason why.

For the sake of discussion let's say this pilot is making a normal spin to the right. Everything is going along okay until he starts the recovery. At this point he fouls up. Let's see what happens.

He applies left rudder against the spin but does not wait long enough for it to take effect. Before rotation stops he shoves the stick forward and is startled to note that the spin is speeding up. A split second later the aircraft goes into an inverted spin. Now, the rudder he was using to stop the erect spin is holding the plane in an inverted spin. Confusion reigns supreme!

If he doesn't get wise, but fast, he's going to run out of sky and luck at the same time. Maybe someone should have told him that he would feel the pull *away* from the controls in an inverted spin.

I would like to re-emphasize one point on erect spin recovery technique for the F-94C. It is really important *not* to use the stick ahead of the rudder, and personally I wouldn't use it simultaneously. If you do come in first with stick the aircraft may wind up for several turns before it wants to recover. The reason for this is that as you use forward stick pressure, you deflect the airflow in such a manner that it misses the rudder. And the rudder is the *primary* control for stopping the spin.

So keep the stick back until the opposite rudder is in and has really taken effect.

I guess that's about all I have to cover on spins. If I've sounded like a primary instructor, it wasn't intentional. However, I would like to leave you with this thought: *When asked about the spin recovery of the F-94C, your answer is — — "No sweat."* ●

Russell M. Roth, Test Pilot, Republic Aviation Corp.

FLYING the F

THE best way to learn how to fly an airplane is to fly it. And I believe that the best way to describe any airplane is to detail each step of a flight from walk-around inspection to landing. So let's get out on the flight line and start from scratch on an F-84F.

You jet jockeys who will be becoming acquainted with the Republic F-84F will have a completely different bird surrounding you than the old F-84 series aircraft.

The F-84F is a swept-wing fighter designed for flight in the subsonic and sonic speed ranges. It is powered by an axial flow J-65 Curtiss-Wright engine, developing 7200 pounds uninstalled thrust. The aircraft lends itself readily to fighter-bomber and long range operations, since it can carry heavy external loads.

The cockpit of the "F" was designed with an eye to pilot comfort. It is similar to the 84G, though slightly larger. The pressurization system provides for greater quantities of air at comfortable temperatures and allows cabin pressurization at lower effective altitudes. A double wall canopy, an anti-fogging dry air circulating system and a flat front windshield provide good visibility.

The aircraft is 43 feet long, has a wing span of 33 feet and is 14 feet from the ground to the top of the fin. Gross weight varies from 18,500 pounds for a clean aircraft to over 25,000 pounds for the aircraft with four external tanks installed.

Actually, in discussing the "F," I will refer to two variations of the aircraft. The first planes that were delivered to the USAF had two-piece tails. A later version of the "F" was modified to include a flying tail. For simplicity, I will refer to each type as two-piece tails and slab tails.

Special Preflight Check

During the usual walk-around check list inspection, I note the position of the horizontal stabilizer, so that when I get in the cockpit, I can see that the stabilizer position corresponds with the cockpit position indicator. Next, I trim the stabilizer to see that the direction of the stabilizer motion corresponds with the position indicator. At this point also, I check the emergency override switch for travel on the longitudinal control to make sure it by-passes the stick grip.

This aircraft is equipped with an irreversible control system, and all control surfaces are actuated by hydraulic pressure. No air loads or surface forces are felt by the pilot. An artificial feel device as nearly as possible simulates in-flight air loads. With this control system, forces present on the ground are nearly identical to those encountered in flight. Forces are proportional to stick motion rather than airspeed and loading. Don't rely on stick forces; rely on airspeed for proper aircraft control.

For a preflight check after the engine is started and hydraulic pressure is available, deflect the stick full forward, full back and to the side and apply full rudder. If the entire control system is okay, the stick will re-center itself after each control movement, and the rudder will return to neutral. In conjunction with this check the artificial feel devices incorporated in the aircraft give you approximately 38 to 40 pounds for full back stick deflection, 12 to 14 pounds for full forward and 18 pounds laterally for full throw. In addition to the above forces, approximately a $1\frac{1}{2}$ pound force is required for initial movement of the stick from the centering detent.

Just before takeoff I arm my jettisoning switches. The inboard jettisoning switch drops the inboard tanks or stores, the outboard jettisoning switch can be used to jettison the outboard tanks or stores, and the panic (emergency salvo) switch eliminates all four tanks and the pylons in case you have to dump them in a hurry during a takeoff emergency.

Before takeoff I run the engine up to 100 per cent and recheck all the engine instruments, particularly the oil pressure, fuel flow, tailpipe temperature and RPM.

On takeoff, rudder breakout forces may cause a slight tendency to overcontrol at the beginning of the takeof roll. Care and experience will eliminate this tendency after a few flights

Watch That Attitude

I would like to emphasize one point concerning the takeoff run. never make any move toward pulling the aircraft off the runway until have nearly reached takeoff speed for the particular configuration. Naturally, I have referenced the Dash One for this, prior to starting the flight. When the plane has reached the de

sired speed range I use a gentle, sustained back pressure to get the nose off and hold a shallow angle of attack. In this attitude, the plane flies itself off as acceleration increases.

The important things to remember here are airspeed and attitude. If a pilot starts the nose up too soon and holds it off at lower speeds, and he has elevator power to do this, he stands a good chance of getting on the back side of the power curve, especially with external stores. You all know what happens then. The plane may break ground but it is going to return in a hurry.

Slab tail aircraft have another built-in safety factor. This model has an auxiliary electric hydraulic system which is available to the flight controls. This alternate control system cuts in automatically if the regular system pressure drops below a critical value.

In addition to the normal and the emergency hydraulic systems, an electrical actuator is connected to the longitudinal control system, and the slab tail can be controlled by actuation of the stick trim button. This system by-passes all mechanical linkage and is an excellent battle damage control, as only the electrical wiring from the stick grip to the electric motor in the slab tail is necessary for longitudinal control.

The above control systems give the slab tailed "F" three separate longitudinal control systems: regular hydraulic, emergency electrical - hydraulic and direct electrical control.

You jet jockeys will be pleased with the way the aircraft accelerates to climb speed; you get to altitude in a hurry.

Okay, the plane is now at altitude, trimmed and ready to go. Let's run through some of the flight characteristics and see how the "F" handles.

This plane was designed for high speeds at all altitudes; flight characteristics are excellent throughout the speed range. The speed is limited only by the thrust available and by total aerodynamic drag. In level flight at high Mach numbers the few trim changes are made easily by using the trim button to readjust the stabilizer.

Aircraft buffet or heavy trim changes are not problems through the trans-sonic speed range. The aircraft remains stable except for a slight tendency to wing heaviness, which is overcome easily with a small amount of aileron.

Stall warning is very good on both the two-piece tail and the slab tail aircraft. First warning is light buffeting, followed by heavy buffeting, and finally by a softening of the controls immediately before the complete stall. Upon stalling, some nose-up tendency is noticeable, but there is sufficient longitudinal control to stop it. In fact, in the slab tail models there is far more control available than ever could possibly be needed.

When the aircraft is stalled, there is a pronounced yaw, usually to the left. This gives an additional stall warning. This tendency is no cause for sweat on a landing, as plenty of rudder control is available to correct the yaw before touching down. When the aircraft yaws, just remember it is ready to pay off.

On any stall, accelerated or unaccelerated, the 84F comes out flying, with no tendency to spin. This is equally true for aerobatic maneuvers. In fact, to spin this plane, a pilot would have to make a deliberate entry and then hold the plane in the spin. To date, spin tests haven't been run, and the F-84F is restricted from spins. Wind tunnel tests with a scale model F-84F have been accomplished and the "F" displayed normal aircraft spin characteristics.

After going through the usual acrobatic maneuvers and observing how well the plane handles, let's go downstairs and see how it handles at low altitudes and on a landing.

Low Altitude Dives

A word of caution for you boys who like to play downstairs at high speeds. This aircraft accelerates rapidly and can really wind up. A bit of explanation from our engineering people as to what can happen if you get too gay might help at this point.

A high speed aircraft loses some of its control effectiveness in the vicinity of and above .9 Mach, so be careful. The point is, don't get in the wrong attitude at any altitude where control effectiveness is essential.

In an emergency some help can be obtained by judicious use of the stabilizer trim. However, be extremely careful about overloading the airplane. As airspeed decreases, control effectiveness returns, and if excessive trim has been applied, high accelerations may be experienced. Use full elevator travel before applying stabilizer trim, so that full opposite surface travel will be available in case you pull excessive G.

I'd like to stick my neck out a little bit in discussing landings. I think it is almost impossible to make a bad landing in this airplane. Okay, I know some joker will make a liar out of me, but he is going to have to try real hard. I just don't believe that today's high performance jet aircraft, and I mean all of them and not just the F-84F, can be flown correctly in the landing pattern if the pilot insists on wracking around in steep, tight turns. I don't mean that you have to fly a Gooney bird pattern to be right; just a modified pattern with normal turns and power.

Although I could quote some figures relative to pattern speeds that generally apply, I believe you should reference the Dash One and thoroughly memorize them all. Inasmuch as a definite pattern is a must in my book, I make my break and bring the plane around smoothly for the downwind. Then the gear and flaps are lowered while holding the recommended speed. I prefer to maintain a good margin above stalling until on final and then begin slowing down as I cross the end of the runway, using a shallow approach. I retain power until I have it made, as this aircraft has a high rate of sink.

Airspeed and Power

I still say that you really have to try to make a bad landing. The point is, control your rate of sink with power and sufficient airspeed and there's no sweat. True, the rate of sink may be deceiving to an inexperienced man, as the plane feels good and solid until he looks out and sees the ground coming up real fast. Then when he comes back on the stick, there is no round out left. Remember airspeed and power, and the problem is non-existent.

After touchdown a pilot has plenty of braking action to bring the plane to a stop. In fact, it is easy to slide a wheel with the power assisted brakes and not even know it. I try to get the nose down fairly early in the roll and start light brake application immediately, rather than wait too long and then be forced to use too much.

Assisted by four JATO units delivering 4000 lbs. thrust, the F-84F really leaps into the blue.

In case a landing is made deadstick, engine frozen or with hydraulic pressure not available, the brakes are on a hydraulic-mechanical system. Brake forces are high, but full action can be obtained, even to sliding the two main wheels.

The F-84F can carry a tremendous load of external stores and still get off well. I think both takeoff and landing run compare favorably with other aircraft, especially considering the weight that can be carried.

I have made flights with the airplane in an asymmetrical configuration, with the equivalent weight of a full 230-gallon inboard pylon tank on one side. Landing in this configuration presents no problem; at slightly above normal approach speed with gear down and full flaps there is still enough aileron for lateral control. However, in case an outboard tank is lost, I recommend dumping the other before landing.

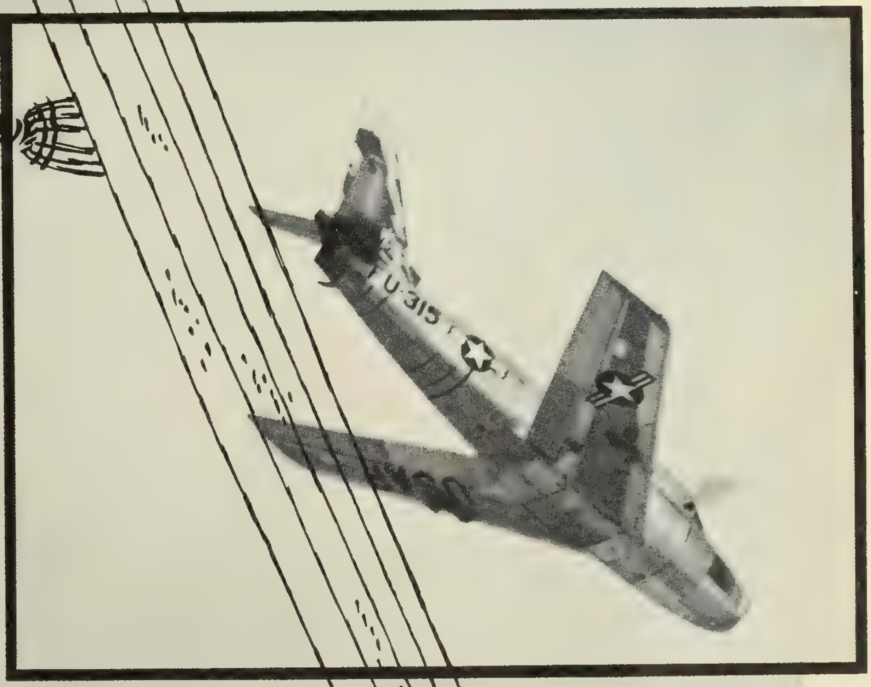
As an added check-up on the two-piece tail aircraft, a factory test was flown on each plane with boost off. This test was made to determine at what maximum speed the aircraft could be controlled properly with boost off. This precluded the possibility of getting an aircraft so out of rig that it couldn't be controlled at higher speeds. Ordinarily, when flying with boost off in the upper speed ranges, the aircraft has good rudder control and fair elevator and aileron control. All flight control in the lower speed ranges is very good.

I suggest that all new F-84F pilots practice flying the two-piece tail model with the boost off. This will enable them to find out just what the aircraft will do under this condition and to familiarize themselves with the changed control characteristics. To practice boost-off flight, trim the plane for straight and level flight in the mid-speed range and turn the system off. When ready to turn the boost system on, retrim the aircraft to reduce high stick forces. Incidentally, on the slab-tail model this is not a problem as it has an auxiliary control system.

In writing this article I tried to mention some of the F-84's features and some of the things about the aircraft that deserve your respect when flying it. To summarize it all I would say this is a fine aircraft; big, fast and rugged. It will do the job for which it was designed and do it well. I think you'll like to fly it; I know I do. ●

Spinning the SABRE

Flight Test Section
North American Aviation, Inc.



IT IS mid-afternoon as an F-86F airplane prepares to take off. The test pilot's schedule indicates that today he is to practice spin recovery. If you were that pilot, would you have any questions on the spin recovery characteristics of the F-86F?

Probably not, for you know that the F-86 airplanes have consistently demonstrated their ability to recover from any type spin using the standard recovery procedure or the hands-off method. However, maybe in the back of your mind a little doubt still persists; maybe you remember hearing about an accident which indicated that an F-86 was lost because of failure to recover from a spin.

Loss of an F-86 in this manner is somewhat puzzling, to say the least. The factory in over 100 actual spin tests has never been able to find an F-86 series airplane that would not recover from any type spin.

On page 13 you can follow a pilot through two spin tests. In one, the spin is entered from a normal, upright one G stall; in the other, the spin is entered from a three G climbing turn.

As an example of the extent of factory flight and wind tunnel spin tests, F-86s equipped with the slat or extended leading edge have demonstrated their spin characteristics in all of the following situations: in both clean and drop-tank configurations; with flaps and gear down and with flaps and gear up; both erect and inverted at low speed; ailerons neutral, against and with the spin; with speed brakes open and closed; power on and power off; forward and aft center-of-gravity positions, and out of accelerated stalls at low

". . . factory test pilots say they have never experienced any kind of spin or spinning maneuver from which recovery couldn't be accomplished satisfactorily using standard recovery technique."

speed and at Mach .9 (snap rolling).

Factory test pilots who have had extensive F-86 flight time say they have never experienced any kind of spin or spinning maneuver from which recovery could not be accomplished by use of the standard recovery technique. In fact, the pilots report that it is difficult to keep an F-86 in a spin.

For example, to maintain spins entered by snapping out of a high Mach number turn at altitude, a stick pull force of 50 to 60 pounds and a rudder force of 200 pounds are required from trimmed level flight. Thus, the test pilots are convinced that merely neutralizing the controls is sufficient to effect spin recovery, although recovery in this manner may take an extra turn to complete. Therefore, it is concluded that in all non-spin-recovery accidents reported, the wrong recovery procedure was undoubtedly used.

All pilots should remember that they have a flying tail which is powerful enough to hold the airplane stalled and in a spin, regardless of rudder manipulation, if the stick is held back. Spins have been entered and recovery completed with the throttle positioned at Military Power; however, retarding the throttle to idle reduces altitude loss during the spin and recovery.

Inverted Spin Characteristics

Inverted spins may occur if the airplane stalls during aerobatic maneuvers. The inverted spin is characterized by a roll into a normal 45-degree dive during every three quarters of a turn. Recovery can be initiated at any time by neutralizing controls and dropping the nose as the airplane rolls upright.

When spin entry occurs from an accelerated turn with external drop tanks installed, it is different from an entry with the airplane in the clean configuration. With drop tanks, the airplane *momentarily rolls into a spin in the opposite direction* to the original turn. It spins one or two turns in this direction and then sharply reverses itself and spins in the original direction (direction of accelerated turn).

Recovery is accomplished as during a normal spin by applying hard opposite rudder and moving the stick forward to neutral simultaneously. Remember, the only difference between spins with and without drop tanks installed is the initial spin entry. The first turn with drop tanks on the aircraft is opposite to the original accelerated turn direction.

Factory spin tests indicate that on the average a normal spin turn requires five seconds, and the airplane loses between 1000 and 2000 feet per turn.

Once spin recovery is initiated, airplane rotation will completely stop within three-quarters of a turn, and altitude loss to complete spin recovery and pull-out will be approximately 5000 feet. Therefore, it is recommended that if a spin is entered below 7000 feet terrain clearance, the pilot should bail out. ●

To help prevent further accidents resulting from spins, the following information and recommendations are offered:

★ Do not trim into a turn.

★ If the airplane snaps out of a turn at any speed, enters a spin from a low-speed, straight-ahead stall, or enters any form of a spin-type maneuver, NEUTRALIZE STICK AND APPLY OPPOSITE RUDDER SIMULTANEOUSLY.

★ It is of utmost importance that the stabilizer be released or the stick brought forward to approximately neutral. RECOVERIES CANNOT BE RELIABLY EFFECTED IF THE STICK IS HELD BACK. Also, because of recovery attitude, full-forward stick is not recommended.

★ If confused as to what recovery technique to use, release all controls.

★ A recovery characteristic of the F-86 is that THE SPIN SPEEDS UP MOMENTARILY DURING RECOVERY. Therefore, don't let this mislead you into thinking your recovery technique is ineffective.

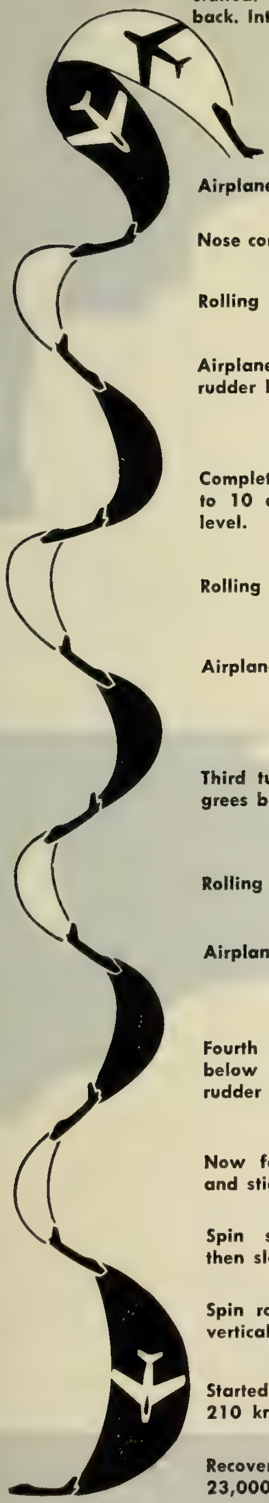
★ It is considered that the spin recovery procedure in the Pilot's Handbook is the equivalent of that given in recommendation No. 2.

★ After rotation has stopped, BE CERTAIN you have sufficient airspeed before initiating any pull-out.

★ To minimize altitude loss in a spin and recovery, retard throttle to idle.

First spin will be entered from a 1G stall straight ahead.

Now at 35,000 feet, 70 per cent rpm. Pulling nose up. 140 knots, buffet starts. 130 knots, airplane yawing. 120, 112 knots, 36,700 feet, fully stalled. Full right rudder, stick full back. Into right spin. Throttle retarded.



Airplane noses down to vertical.

Nose comes up to horizon, wings level.

Rolling to the right, nose drops.

Airplane noses down to vertical. Slight rudder buffet.

Complete second turn, nose comes up to 10 degrees below horizon, wings level.

Rolling to the right.

Airplane noses down to vertical.

Third turn, nose comes up to 40 degrees below horizon, wings level.

Rolling to the right.

Airplane noses down to vertical.

Fourth turn, nose about 60 degrees below horizon, wings level. Heavy rudder buffet.

Now for recovery. Hard left rudder and stick to neutral.

Spin speed increases momentarily, then slows.

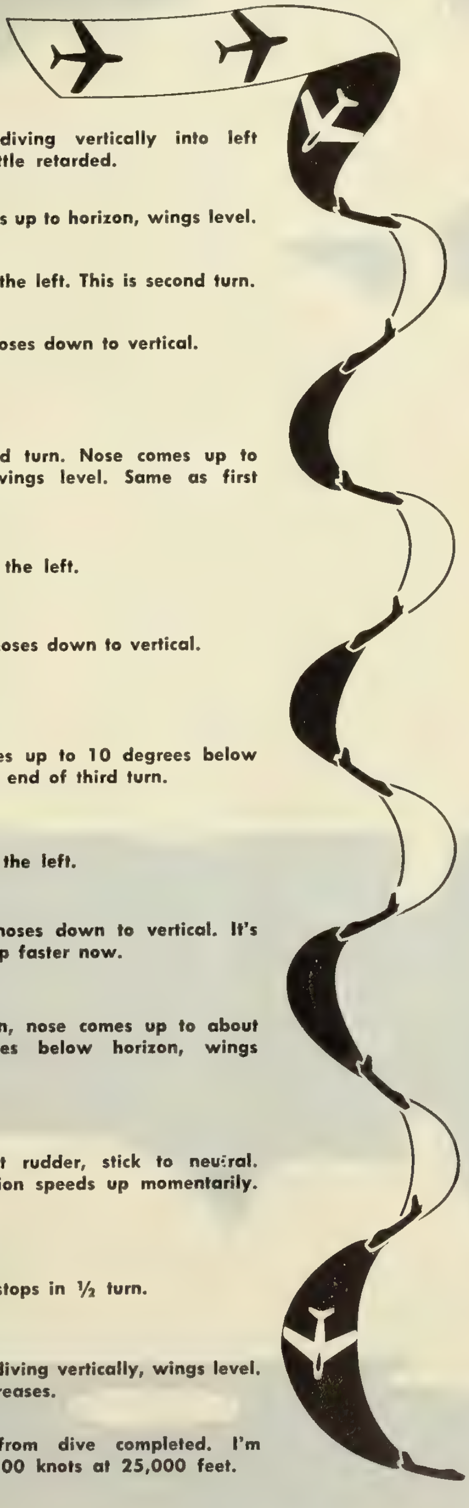
Spin rotation stopped in ½ turn. In vertical dive. Airspeed increases.

Started 3G pull-up at 25,000 feet. 210 knots.

Recovery complete, flying level at 23,000 feet. Everything fine.

This will be a four-turn left spin from a 3G climbing turn.

Altitude 35,000 feet. Military Power and 100 per cent rpm. Now turning to left. 2G, now 2½G. Heavy rudder buffet. 3G at 150 knots. Stick full back, full left rudder.



Airplane diving vertically into left spin. Throttle retarded.

Nose comes up to horizon, wings level.

Rolling to the left. This is second turn.

Airplane noses down to vertical.

End second turn. Nose comes up to horizon, wings level. Same as first turn.

Rolling to the left.

Airplane noses down to vertical.

Nose comes up to 10 degrees below horizon at end of third turn.

Rolling to the left.

Airplane noses down to vertical. It's winding up faster now.

Fourth turn, nose comes up to about 60 degrees below horizon, wings level.

Hard right rudder, stick to neutral. Spin rotation speeds up momentarily.

Spinning stops in ½ turn.

Am now diving vertically, wings level. Speed increases.

Pull-out from dive completed. I'm level at 200 knots at 25,000 feet.

ANYMOUSE and his hairy tales

This Anymouse article is one of the finest hairy tales to brush across FLYING SAFETY editorial desks in a long time. The author leaves no doubt in his readers' minds as to what happened and why.

The most important point of the story is that it happened to an experienced instructor pilot. This pilot planned a flight carefully, and thought he left nothing to chance. But he overlooked the human element, both in himself and in others. Through a series of assumptions, acts of carelessness and because of a bad case of that "ole debbil" get-home-itis he came mighty close to getting in a real jam.

This story has a message for all jet pilots, both the tyros and the old hands. It reads . . . don't let it happen to you.

THERE I was, flat on my back at 45,000 feet on a pitch black night, surrounded by thunderstorms and out of oxygen. This start to the typical "war story" wasn't really that bad, but the T-bird was sure shuddering as she hit the red line while I had my head down tuning in the next range.

It had all started about four hours before when I arrived at operations for a little night flying. Since I've always been bored with "flying around the flagpole," I figured it would be a good opportunity to check myself out on my night navigation and cruise control. So I spent the next two hours planning a round robin with the aid of one of the new experimental Jet Navigation Charts, cruise control chart, E6D computer and a Radio Facility Chart. I really planned the flight, too—I knew exactly where I'd be when I reached altitude, when my tips would run dry, when to start my letdown and how much fuel I'd have remaining when I stop-cocked her. In fact, I was primed for a good three hour and ten minutes flight. I was so sure of my planning, I'd even told my wife to pick me up at 2330. But as someone once said about the best laid plans of mice and men — —.

My woes started when one of the airmen from the tower brought in a fresh jug of coffee for the boys in ops. When he heard I was going round-robin in the T-bird, he asked if he could go along. He assured me (and it was verified by the personnel on duty in ops) that he had had altitude indoctrination. Big-hearted me, I replied that it was just as cheap to fly with two as one, and for him to check out a chute, P-1 and mask from personal equipment. While he did this, I checked weather.

It was strictly VFR except for possible thunderstorms over Phoenix. But no sweat there — they'd top at 35,000, so the forecaster told me. When we reached the ship, it took me longer than usual to check it over, because I was going to have everything right on the ball on this flight! I checked everything on that walk-around. I was also held up an additional thirty minutes while I assured myself of the fit of my passenger's oxygen mask and his knowledge of the operation of a "hot seat."

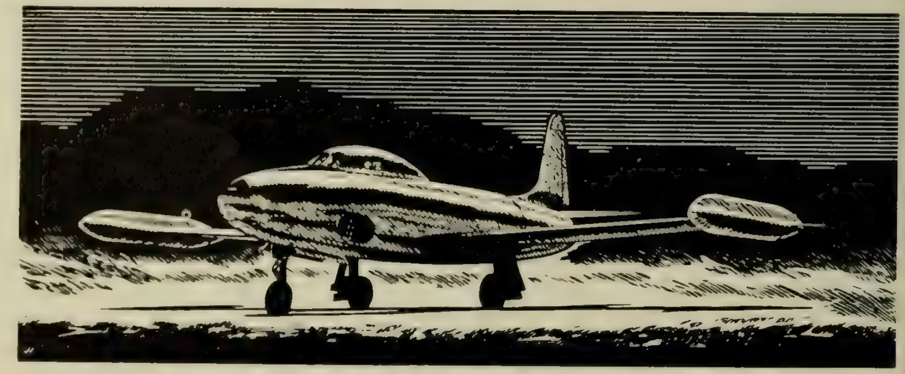
We finally got off the ground and I climbed on course to 38,000. I ran an oxygen check on my passenger about every ten minutes and indicated to him when we got to altitude that our cabin pressure was 26,000 feet. When I was out about 350 miles, I looked down at the oxygen gage and noticed that I only had 200 pounds of oxygen. I asked my passenger if he was on 100 per cent. His gay answer of "Yes Sir, I sure am," brought a quick reply from me to put it on "normal" and leave it there.

Over Phoenix, at about 560 miles I ran into the predicted thunderstorm activity but had to climb to 45,000 for about 10 minutes to top them. (So what's a 10,000-foot error to a forecaster?) I dropped back down to 38,000 and called the next station to change my penetration altitude to 25,000 feet since by this time the oxygen gage read 100 pounds. I hit my penetration right on schedule and immediately dropped to 18,000 to get cabin pressure down below 10,000, since by this time oxygen was what I was fresh out of.

Naturally, there was my round robin—shot. So I headed for the nearest Air Force base for fuel. Called in and changed my flight plan and explained my difficulty. I came in, landed and was led out to the "pea patch" for parking.

Now, here's where the fun really begins. First, I told the alert crew

. . . slightly miffed because the Alert Crew had parked him out in the middle of the pea patch.

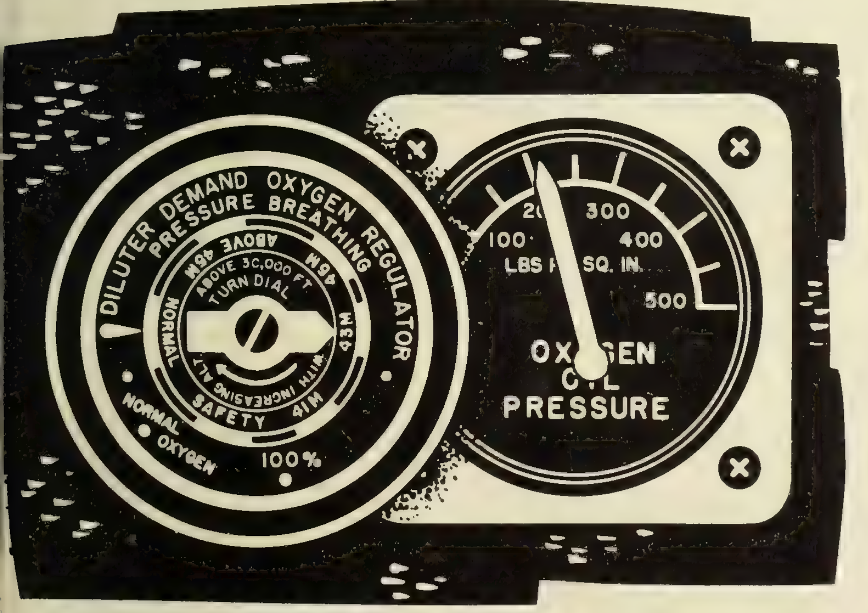


hat I wanted oxygen and fuel, and ince I was only an hour from home, only wanted 50 gallons in the tips.

Second, I went into ops and waited or over an hour until the gas crew ame back from chow (those boys nust have been really hungry).

Third, I finally got a clearance nd headed for the "pea patch" again. t was while headed to the "pea atch" that the alert crewman said e had given me 400 lbs. of oxygen ervice, but by the time he got up to he rear cockpit and turned the regulator off of 43,000 the pressure had ropped to 200 pounds. That set me ff on a tirade about the stupidity of ertain individuals who were supposed to know how to use a pressure lemand regulator. My passenger's eply was that he had been instructed (1) go on 100% oxygen above 0,000 feet, and (2) to the pressure ystem above 40,000. I then patiently xplained the principles of pressuriza-on and asked him if he remembered y calling back cabin pressures to im. He did, of course, but believed nly the altimeter in front of him.

". . . by the time he turned the regulator off of 43,000 the pressure had dropped to 200 pounds."



Fourth, I climbed into the airplane fter a very cursory exterior check after all I'd just flown it myself, adn't I?) and no check of the Form A, looked at the fuel totalizer and et it at 453 gallons (naturally, the lert crew had failed to set it), lit e wick and started taxiing. I wouldn't say exactly that I was in a hurry, but it was after 0100 and my wife was waiting at ops, and she's still relatively new at this Air Force wife routine. Besides, I was more than a little miffed at having to wait for go juice. And in addition I resented having to park in the "pea patch" which was as dark as the inside of a cow. Anyway, as I taxied out, I checked out my tips and found them to be feeding okay.

I couldn't quite figure out why I leaped off the deck so fast when I poured the coal to it, but it only took about 10 minutes to find out. About that time I noticed the red lights for the tips and a drop in the fuselage tank, to about 80 gallons so I switched to leading edge. Guess what — red light! Next the wing tanks — same story. Just about this time I was in the midst of a 3G, 180-degree turn and I heard my passenger say, "Gee, isn't it pretty down there." That, as the expression goes, ripped it. I told him in no uncertain terms to shut up, put his hands in his lap and just sit there until we got on the ground.

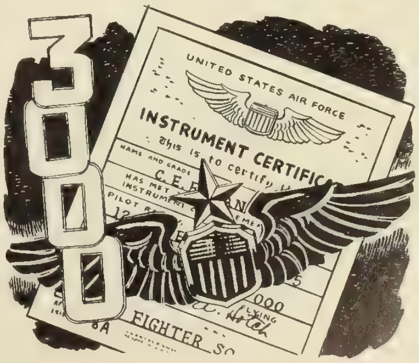
As I started a letdown back to the field from whence I came, I grabbed the Form 1 (now he looks) to see how much fuel I had gotten. For the life of me, I couldn't find entry No. 1 as I flicked back thru about four pages of 1A's. Called into the tower for landing again and was asked immediately "wha hoppen." I told them I was slightly short on go juice, but since I was already on initial and 3 out, I had it made. I did qualify it to state that although no emergency existed, it would be "no go-around."

When I got on the ground I started in with the alert crew. Their answer was, "You said only 50 gallons in the tips." This I did, but I apparently made an erroneous assumption—that they had sense enough to service the bird with internal fuel. Next, I jumped the gas crew to find out why no entry had been made in the 1A. "But, it's there, sir!", so I said "Show me." They were right, there it was—exactly eight pages in back of the current form. The best I could figure is that their procedure is to note the gas on the page where the form happens to fall open. Needless to say, I not only checked the tanks prior to takeoff—I filled them myself.

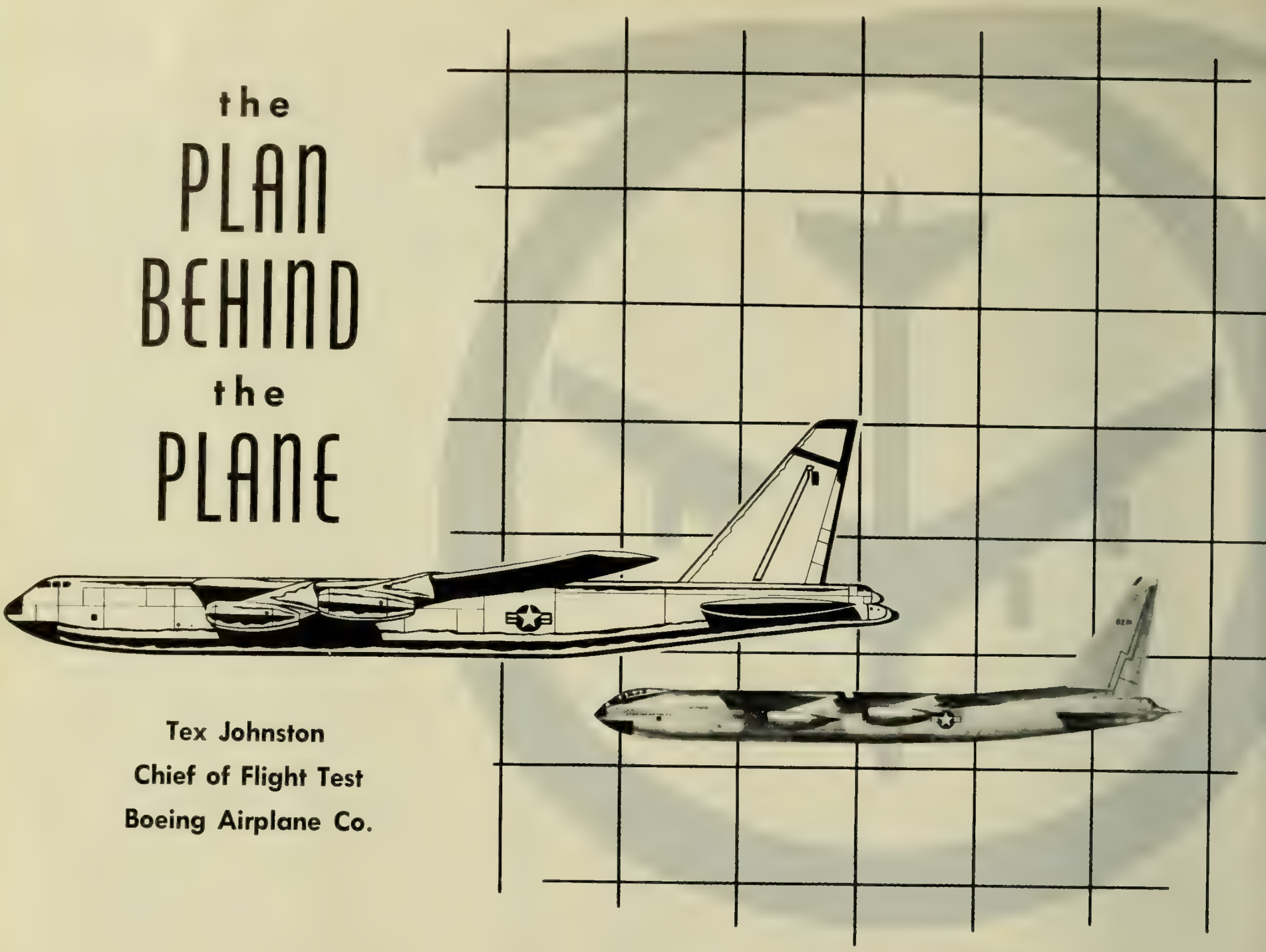
I learned some lessons that night—the hard way. I don't know how many cadets I've "chewed out" for pulling identical tricks to mine. But, of course, that was quite a few years ago when I was instructing—ten to be exact. I guess I've grown complacent, and maybe a little too "hot" just because I've got a green card, a star on my wings and 3000 hours behind me. I know I'm not the only one with this trouble and that's why I'm writing this *Anymouse.* After nights like that one, I begin to feel that I'm still alive *in spite* of my techniques, and not because of them—and believe me, it's not a good feeling.

P.S.—I now fly no passengers on X-C in the T-Bird unless they are rated, and it takes me exactly 20 minutes longer to check out any aircraft I fly, every time I fly it. Also, I don't care if my wife's been sitting in front of ops for 10 hours. As the saying goes "you're a long time dead," and she was only mad for three days. ●

". . . a star, 3000 hours and a green card."



the PLAN BEHIND the PLANE



Tex Johnston

Chief of Flight Test

Boeing Airplane Co.

WHEN the Boeing B-52 Stratofortress heavy bomber is delivered to the first Strategic Air Command wing to be so equipped, it will fly to its operational base powered by eight Pratt & Whitney J-57 engines; it will be laterally controlled by spoilers instead of ailerons; trimmed fore and aft by means of a positionable horizontal tail, and landed on a dual tandem undercarriage, which has eight wheels.

These features and others are "firsts" for heavy bombers. They are successful components which add to the big bomber's operational efficiency and ease of handling. They are new features, but there is a long story behind them.

It begins with ideas believed to fill specifications; it continues through careful experimentation and careful design. Then comes construction of the first airplanes; then testing, improving and more testing, while production airplanes are being built and made ready for delivery. This is necessary if the airplane delivered to Air Force bomber crews is to be a dependable weapon which can be used efficiently by those crews.

While all of the background work behind the bomber as it is delivered to Air Force crews is equally important, it is proposed to limit this discussion pretty much to the testing of the airplane, the organization behind the testing and changes for the better made as a result of test flying.

Aeronautical design is becoming more and more an exact science. An airplane produced from the designs of an intelligent engineering organization, and checked out in a wind tunnel and other laboratories, is almost certain to be able to take off, maneuver and land with no great sweat. But this is not to say that it will be the perfect operational instrument throughout its range of speeds and altitudes, nor that every part of it will be okay. It remains for the test crews to determine just how close the designers have come to perfection and in what ways they have falle short, so that the airplane type ca be developed further.

Stated another way, the reason behind test flying are; to seek ou constructively the capabilities of th aircraft, and to produce the best possible information for the airplane' successful development. Thus the tes flying activity is a continuing effor to make a new airplane type bette and better, to the limit of the basi design's capabilities.

This improvement of the airplane through development testing is called "stretch." It is illustrated perfectly by the case of the B-47 Stratojet. The XB-47, prototype of that bomber, first flew in December 1947. At that time its maximum gross weight was 120,000 pounds. Since then, developmental testing has kept stables of B-47s busy on experimental flying at Boeing flight test centers in both Wichita and Seattle. This bomber type has been improved continually until now its maximum gross weight for takeoff is 205,000 pounds, and development testing still continues.

Experimental testing is not a solo effort by test pilots, of course. While there are six pilots engaged in testing various B-52s experimentally at the Boeing Airplane Company's flight test center in Seattle, and three B-52 production test pilots; there are behind these flyers nearly 500 expert engineers and technicians processing data obtained by the many instruments which can gather more than a million facts in a flying hour. Their job is to determine what the data signifies with respect to the airplane's systems and components and structure, and to keep the flight test instruments in shape.

This work is carried out in a new flight test center at Boeing Field in Seattle, a $5,800,000 facility made up of a hangar capable of housing comfortably five B-52s, drafting rooms, radio rooms, laboratories, offices and shops. The installation was designed as a base for modern and efficient flight test activity and to deal with the complex job of testing modern airplanes such as the B-52. In this way, knowledge gained on test flights can be put to use to develop constantly improving airplanes.

Air Force test pilots of ARDC, from the Flight Test Center at Edward AFB, with duty station at Seattle are assigned to B-52 testing. They cooperate with Boeing test crews in accumulating knowledge regarding the airplane and criticize it constructively from the point of view of the military pilot and crewman.

What will B-52 flight-testing mean to the pilot and crew of an operational Air Force bombing wing?

It will mean, first of all, that the airplane has been proved completely under all conceivable operational conditions short of flak. It will mean that the airplane has been developed with the goal in view of making it a weapon which is dangerous only to the enemy — not to the crew.

Test flying also will mean to the pilot and crew that every system and component of the airplane has undergone checks prescribed by Boeing's flight test organization.

Flight testing the B-52 began in early 1952 when, with an ARDC officer as copilot, I took the airplane off on its first flight.

The testing continued on further flights, as handling qualities, stability and control, performance, structural integrity and other items were investigated under controlled conditions.

At the same time, oscillographs, Brown recorders and photo recorders were gathering data on the airplane's structure, power plants and systems.

There were many new features on the B-52 to be tested—the double-tandem landing gear, the spoilers and the positionable horizontal tail.

As each system and component on the airplane underwent systematic testing in the air and on the ground, improvements were made and incorporated into the test airplanes as the need arose. The process went like this. Something might be discovered that did not function quite as planned when it was originally designed. This would be reported either by the pilots, or by flight test engineers who discovered some evidence of the imperfection through their instrument recordings. Staff or project men in Boeing's engineering organization would then seek some method to correct the imperfection. This "fix," as it is called, would then be incorporated in the airplane and tested in flight to determine if, indeed, it were a "fix." If it were not, another "fix" would be incorporated and if required, another; and each in turn would be tested until finally a proper "fix" was found to cure the imperfection. Then the "fix" would be incorporated into the airplanes on the production line or during modification, and a more dependable airplane would be the result.

While the design of the B-52 was of such high quality from the outset that there were no real major problems discovered in testing it, there were some of smaller proportions.

Some of these were discovered in flight, some were discovered on the ground, some were even discovered in the wooden mock-up. As a matter of fact, the wooden mock-up was the scene of forty mock-up inspections. Both Air Force and Boeing aircrew members and engineers operated controls and carried out simulated missions or observed them.

The test pilots, having a good deal of time logged leaning back against their parachutes, qualify as experts in cockpit requirements. On several occasions they defined a problem in design and suggested solutions.

A case in point was the fuel indicating and control system. The fuel indicators at first were arranged on the copilot's side of the production airplane cockpit in a way which, while clear when considered on the ground, might prove to be confusing during flight in conditions of darkness or when the copilot was fatigued.

It was suggested by an ARDC pilot that it would be better to arrange the fuel indicators in accordance with the arrangement of the tanks in the airplane, with the outline of a wing drawn around them. This gives the copilot an immediate picture of the fuel situation with no confusion. If he wants to know how much fuel remains in the outboard wing tanks, he has only to look at the outline picture of the wing in front of him and check the tank gages on either wing.

Another of the changes brought about through pilot study of the cockpit had to do with the fuel control handles. These, when in the ON position, were at right angles to the diagrammatic presentation of the fuel tanks on the original fuel control panel. Even though there were painted lines across the control handles to indicate the flow, it appeared that the handles were blocking fuel lines in the diagram. It was suggested that the fuel control handles be changed so that when ON they pointed along the fuel flow in the diagram. This suggestion was incorporated into the airplane.

Above and beyond the actual testing and the development of the airplane, the experience gained by the test crews becomes valuable as a means of furthering the reliability and the efficient operation of the airplanes. Pilots and crews, as well as flight test engineers and aerodynamicists, have worked closely with handbook engineers in preparing the pilots notes, the bible of the operational airman. Written from the experience of the test crews and checked closely by them before being printed, these notes are a summation of the total experience in flying the airplane, and as such are a valuable product of experimental flying.

All of the testing the B-52 has undergone and will undergo will be invaluable to the operational aircrews who will finally put the airplane to the use for which it was intended. While the airplane would probably be flyable as it was designed, it has been demonstrated in flight that it is more than that. Improved by the refinements growing out of the experimental and developmental testing by Boeing crews, the B-52, successful from the first, is an even more dependable and practical bomber than it would otherwise have been. ●

IT'S JUST A CASE OF . . . . . + and −

Prepared by Hq., Crew Training Air Force
Randolph AFB, Texas

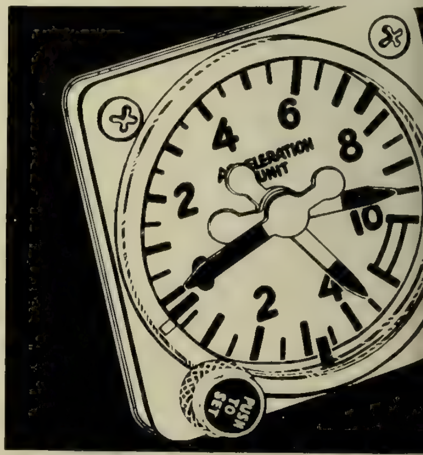
BOTH the design engineers and the Air Force have a pretty good idea of just how many flying hours they should be able to get out of each aircraft manufactured. In fact, they agree on a series of specifications before the aircraft is designed and built. One of the limiting factors in any aircraft is its ability to withstand the effects of gravity and different multiples of gravitational force. To you and me, as pilots, it can be simply stated as G loads.

Each aircraft has a designed maximum G load, which is stated in the Pilots' Handbook; and if we keep the aircraft within this limitation, we can expect it to last through its normal life expectancy. Incidentally, this is a good way to insure reaching retirement age ourselves! But, if through error, accident or ignorance we exceed these limits, we reduce the life expectancy of the aircraft and perhaps even put it in immediate, permanent retirement. The last statement is not the condition that we are really worried about however, because the lad that is foolish enough to exceed the ultimate strength of the airframe usually pays for the mistake himself. It is the area between the maximum allowable G forces and the actual breaking point of the airframe that gives us the greatest concern; because if we exceed the allowable limits often enough, we will still cause the destruction of the airframe. It is surprising the limited number of times this excessive G load can be imposed before failure is possible.

Let's take a typical fighter aircraft and say that the maximum G loa allowed in the Pilots' Handbook 7G. Theoretically we could fly aroun in a 7G turn for the entire life of th aircraft and nothing would happen- in practice this is true for two ver important reasons. First, because th maximum G force allowed is consi erably less than the ultimate destructive G force and, secondl because we would wear the aircra out through normal usage before th G load could cause any damage. Let also state that the ultimate load fa tor for this airframe is 11G, an when we impose this load factor, th airframe fails, falls apart, disi tegrates or what have you. So no we have established two limits: on which is the maximum allowable 7 that we may pull as often as we lik and the other which is the ultimat destructive force of 11G that we ma pull only once. But how about thi area in between?

We all know that the 7G limit exceeded quite often, and seemingl with impunity. Who ever heard of pilot getting into trouble pulling or 9G? But it's the ones that we don' hear about that cause the doubt an wondering. Design engineers tell u that there is a definite number o times that we may get away wit exceeding the maximum allowabl G load, and the number decrease progressively and drastically as w increase these loads. Considerabl study and research have been con ducted on this problem, and althoug it has not been reduced to an exac figure, they state that an airfram with limitations such as we have dis cussed may be loaded to 8 or 9 about eight times. After that it wil possibly fail!

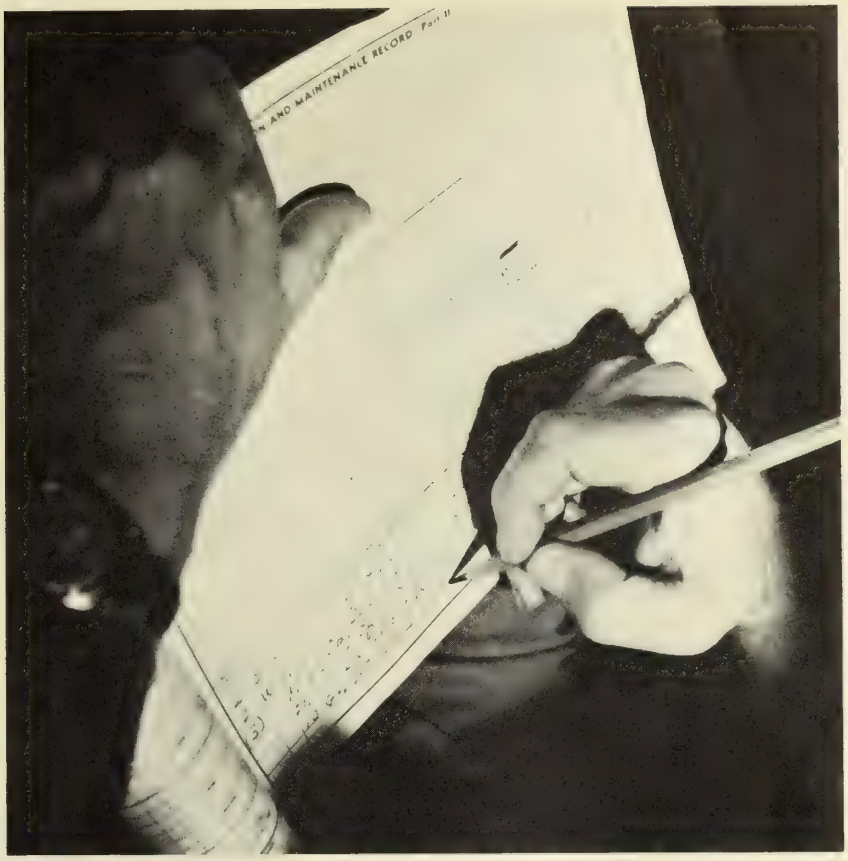
Engineers state there is a definite number o times max allowable G's may be exceeded



Each load imposition beyond the maximum allowable force reduces the life expectancy of that airframe. Our objective in expressing and stressing this is to acquaint you with the inherent danger of exceeding the G limitation and to point out the very obvious danger of not regarding these over-load conditions if they do occur. The insidious part of the whole situation is a lack of visual evidence after an over-load condition. Usually it is impossible to tell that the aircraft has been subjected to excessive G even after giving it a routine inspection, and it is normal to reschedule it for further flights. However, the pilot who pulls 9G on our hypothetical aircraft after seven other lads have done it before him is in for a rude shock. Whether he meant to exceed the limits or not, the darned thing is going to come apart on him because he has used up the last bit of available life in that airframe at that particular G load.

We could also compare this situation to a given amount of money in our bank account. This amount is a fixed sum, adequate to see us through our normal life span provided we never exceed a maximum monthly withdrawal, and reducible at any given rate we choose. If we draw the whole amount at once for a bang-up time, that's all there is; we're through, finished, on our uppers. The same is true of the aircraft and the 11G. If we withdraw sums larger than our maximum monthly allowance, we reduce the principal by that much, and it is obvious that we cannot make it through the full life span on the amount we have left. Sooner or later, depending on how often we make these excessive withdrawals, we are going to be without support. So, too, with the aircraft when a pilot toys with the area between the allowable limits and the ultimate limit. We can pull these extra G loads, the option is up to us, and we can get away with it—for a while. But each time we do, the life of the aircraft is reduced by a definite amount, and sooner or later we use it up. If we use our heads and never exceed the maximum monthly withdrawal, there will be plenty to last our life time; with the aircraft life we have even a more rosy picture; if we abide by the maximum allowable G forces, the aircraft will still be in good, usable shape when it reaches retirement age.

". . . if we exceed limits, we reduce the life of a plane, perhaps retire it permanently."


AND MAINTENANCE RECORD Part II

". . . if you do pull excessive loads inadvertently, write it up in the Form I and give the other guy a break . . . after all, there's no question but that you want him to write it up there for you."

This, then, is our story. It is true for all types of aircraft — fighter, bomber, cargo, trainer and even gliders. Each has a designed life span, and each has an ultimate G load, or the point of destruction.

But the type of aircraft that is most likely to be overloaded is the high-speed one with the powered flight control system. Types available to us in the past required a good deal of brute force applied to the controls to get us into situations similar to those mentioned above. Now, with the advent of powered controls, it is easy to understand how a pilot could exceed the limits without really trying to do so or even intending to; he just doesn't realize the terrific potential he has at his command through the use of powered controls.

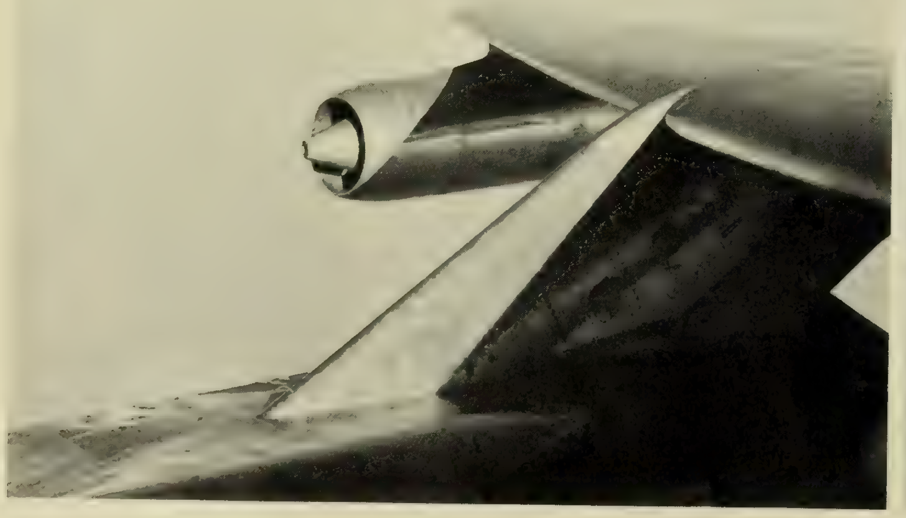
We must educate pilots in two ways: in the use and limitations of their aircraft in regard to the allowable G loads and the ease with which they may overstress the aircraft, and in making an entry in the Form 1 each time the maximum G loads are exceeded. If ever there is a case to which the Golden Rule applies, it is here. If you do pull excessive loads inadvertently, write it up and give the other guy a break — after all, there's no question but that you want him to write it up for you!

In conclusion, there's not a single maneuver which can't be executed within the allowable G limitation. If you're pulling excessive G, you're not flying the airplane—you're horsing it around, and you're in the bank, yank and crank category. ●

STRAIGHT and SWEPT

R. J. White and A. T. Curren

Boeing Airplane Co.



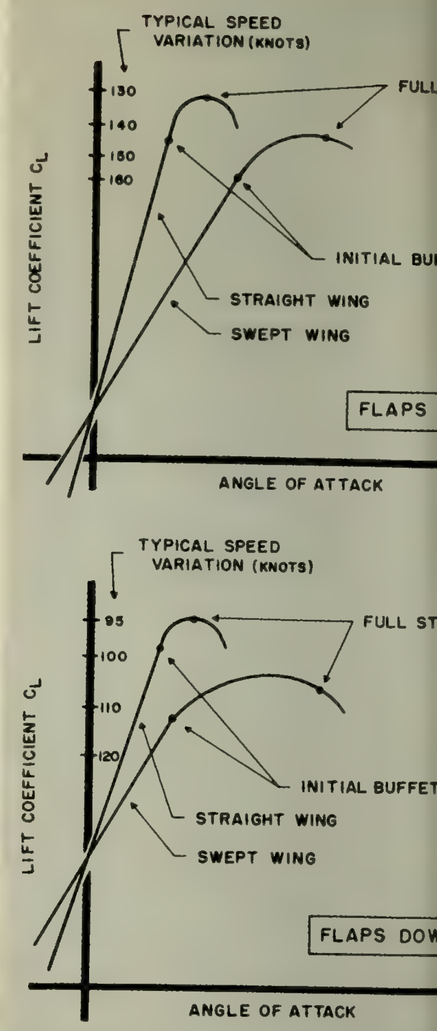


FIG. 1

For many years aircraft designers have toyed with the idea of introducing swept-wing designs. As airspeeds have increased, so too have the problems that crop up near the sonic barrier. Buffeting, aileron buzz, pitch-up and other allied ills have accompanied attempts to squeeze more speed from our aircraft. The logical question then was, will a swept-wing design solve some of these problems?

Some manufacturers firmly believed that maximum performance could be achieved with straight-wing aircraft. Others were of the opinion that a swept-wing design was the answer. As a matter of fact, both schools of thought have merit. As aircraft designers progressed further into this swept-wing business, certain flight characteristics manifested themselves that bear careful consideration. One particularly undesirable trait concerns stall tendencies when the aircraft yaws. This is more pronounced in some types than others, i.e., fighters vs. bombers, and consequently the Directorate of Flight Safety Research believed that a survey of design thinking would be valuable to our readers.

Accordingly, a series of questions was submitted to two manufacturers, one for swept-wing and one for straight-wing aircraft. In general, the questions covered the following:

- *In what maneuvers or attitudes are swept-wing aircraft exposed to loss of control because of differenc in airflow over the swept-wing a compared to a straight-wing?*
- *What are the effects on contro when operating multi-engine swept wing jets with engines inoperative o one side or with partial power o both sides?*
- *Is yawing the most significan or the only maneuver which should be avoided?*
- *What degree of yaw (or other maneuver) is considered dangerous in swept-wing aircraft?*
- *At what airspeeds is yawing considered dangerous on swept-wing aircraft?*
- *What corrective or precautionary action is recommended?*

THE introduction of high speed swept-wing aircraft into widespread military operation has resulted in many questions from flight personnel concerning the basic design differences between the conventional straight-wing and the swept-wing. This article will explain some of the stability and control characteristics of aircraft with wing sweep in the order of 35 degrees.

We will review several of the main characteristics affected by sweeping he airplane wing and will compare hese characteristics with those of an unswept-wing plane, where possible.

In general, the flight characteristics may be discussed by considering stalling, pitching and lateral and directional control. These will be discussed separately in detail.

Stalling Characteristics

Basic differences in the stalling characteristics of swept-wing and straight-wing aircraft are clearly illustrated in Figure 1. These plots do not represent any particular aircraft.

Note that with flaps up the lift curves are similar, and stall warning margins are good in both cases—10 to 20 knots. Maximum lift and minimum speed occur at a greater angle of attack or steeper attitude in the swept-wing airplane. (Attitude or angle of attack may be considered as interchangeable in this discussion.)

In flaps down configuration the straight-wing demonstrates a smaller spread between initial stall warning attitude and the full stall attitude.

With flaps down the swept-wing has a gradual rounding of the lift curve similar to that for flaps up. Figure 1 shows the top of the lift curve to be quite flat. Here the stall warning is definite, but a substantial increase in angle of attack is necessary to complete the stall. As the angle of attack increases, the drag also increases very rapidly, so that a large rate of sink may develop prior to the full stall. In fact, at low engine thrust the stall break may not be apparent to the pilot because of high sink rates. The full stall is usually accompanied, however, by strong buffeting which is termed "vertical bounce" by pilots.

Flaps Down Approach

The flaps down approach characteristics are important because the pilot is operating close to the ground and near the initial stall buffet speed during the approach for a landing.

There are both straight-wing and swept-wing jet aircraft which have low drag in the approach configuration due to aerodynamic cleanness. Some of these aircraft are also equipped with jet engines with poor acceleration capabilities. On these planes the low drag requires a fairly flat approach at low engine thrust to avoid building up excess approach speed which can result in a long floating distance before the aircraft settles down on the runway. Because of the relatively long time (6-10 seconds) required to accelerate from idle rpm to moderate thrust values, pilots must be alert for the following sequence during landing.

With the aircraft on final approach, flying approximately 10 knots above the initial buffet speed, the pilot may attempt to maintain the desired flight path by raising the nose of the airplane slightly and accepting the loss of a few knots in airspeed. Only a small increase of lift coefficient is required to balance the speed decrease. However, due to the shape of the liftdrag curve (C_L versus C_D curve), a large percentage of increase in drag occurs. This is illustrated by point A to B in Figure 2. Unless thrust is immediately increased, a further speed decrease occurs because of the additional drag, and the cycle repeats itself until the first stall warning occurs. Figure 2 shows a plot of rate-of-climb or rate-of-sink versus airspeed at low engine thrust.

From this it can be seen that if the airplane is flown at an approach speed too near the first stall warning, high rates-of-sink may be encountered very easily. This rate of sink can only be checked by nosing down to re-establish speed or by applying power. A loss of altitude will occur when a pilot noses the aircraft down to pick up airspeed. This will occur also in any instance where the jet engines require too long a time to accelerate up to speed from idle.

The only way to avoid this situation is to plan ahead. Allow the necessary time to accelerate the engines up to the required power, or to have sufficient extra drag in the approach configuration so that a larger percentage of power can be used during the approach. This latter will permit the engines to accelerate faster and will permit the pilot to effectively adjust his glidepath by use of engines only.

Pitching Characteristics

Unlike the airplane lift characteristics, there can be no direct comparison between the pitching moments of swept-wing and straight-wing airplanes. The reason for this is that undesirable pitching moments may occur for either type airplane, and in each case these must be modi-

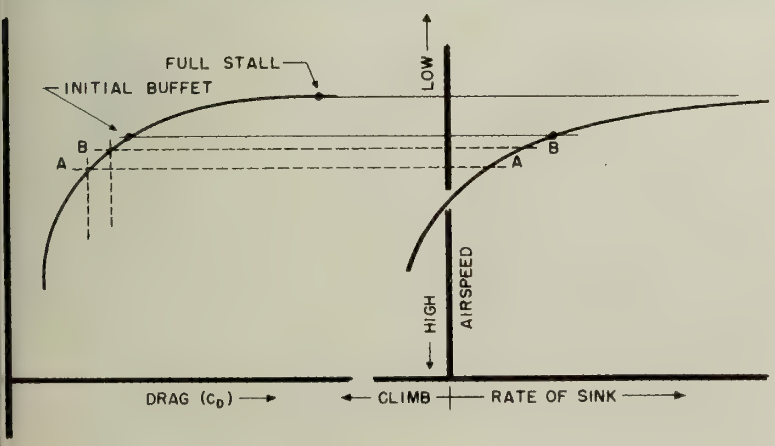


FIG. 2

fied during the airplane design to give satisfactory pitching moments.

The swept-wing at low speeds first showed that pitch-up (unstable pitching moment slope) can occur at the higher lift coefficient. This pitch-up is due to the stalling of the tip areas which are behind the center of gravity. This causes the inboard lift ahead of the airplane center of gravity to rotate the airplane in a stalling direction. The low speed pitch-up tendency can be cured completely through proper wing, tail and nacelle design. This is essential for a good flying airplane.

As airplane design approached sonic speed, the effect of Mach number produced a high speed pitch-up tendency for many airplanes, both swept and straight-wing. In addition, variations in the pitching moments occurred with increasing Mach number, giving rise to an additional flight effect referred to as tuck-under.

There are, therefore, three pitching moment problems which must be controlled or reduced to a minimum in the design of any high speed airplane. These pitching problems are:

- *Low Speed Pitch-Up*

Low speed pitch-up may occur during a low speed stall. Here the nose of the airplane may gently come up as the stall is approached, after which a pitch-down will occur. If this effect is mild, the airplane may still be satisfactory. A severe pitch-up tendency without a following pitch-down cannot be tolerated.

- *High Speed Pitch-Up*

The high speed pitch-up may occur during an accelerated pull-up. Here more G is suddenly realized than can be momentarily controlled by the pilot. This effect is, of course, undesirable, but can be tolerated if the tendency occurs well above the normal operating conditions of the airplane, and if the pitch-up does not result in excessive load factors.

- *High Speed Tuck-Under*

The third pitching moment effect is tuck-under. This condition is associated with a change in airspeed and trim during level, unaccelerated (1G) flight. Here, at a certain high trim speed, the airplane may have a tendency to increase airspeed gradually and nose down, requiring the pilot to retrim. If this condition is mild and does not occur in the normal operation conditions, the airplane is satisfactory, providing the pilot has sufficient elevator and trim control to bring the airplane back to the desired trim speed.

Lateral and Directional Control

The lateral control for the swept-wing airplane must be increased over that used on the straight-wing airplane. The reason for this is that the airplane rolling moments developed when the airplane is yawed are greater for a swept-wing than for a straight-wing during low speed flight. Here it is necessary to provide sufficient lateral control to hold the wings level when flying at yaw angles up to the maximum yaw that can be supplied by the rudder.

The rolling tendency produced by yaw is the same as that which would result with a straight-wing having a large dihedral angle. When an airplane with dihedral is yawed, each wing experiences a change in angle of attack which results in a rolling moment. A 35-degree swept-wing with no dihedral has the same rolling tendency at low speeds as a straight-wing having 15 to 20 degrees of dihedral. The effect of excessive dihedral requires the pilot, during steady slideslip maneuvers, to use more lateral control than would be required on a straight-wing airplane. By providing sufficient lateral control with low control forces, desirable flying qualities can be obtained.

It should be noted that the large dihedral effect is in the stable direction. In airplanes with insufficient dihedral, the advancing wing drops when the rudder is applied in a sideslip, thus producing undesirable flying characteristics.

It should be noted that many airplanes are limited in the yaw that can be produced by the rudder at the higher airspeeds. This yaw restriction is purely a structural limitation to save weight in the vertical tail and associated body side bending material. The general way of limiting the high speed yaw angles is to increase rudder pedal forces with airspeed.

In regard to the dynamic effects, stability theory indicates that excessive dihedral will produce an airplane lateral instability referred to as "dutch roll." In many present day aircraft, because of high wing loadings and undesirable inertia characteristics, this instability results even in straight-wing airplanes. This has led to the development of the yaw damper which is used to improve th "dutch roll" characteristics.

Engine-Out Flight

A yawed flight condition can occu when an engine fails on a mult engine airplane. In a propeller-drive airplane, loss of an engine reduc the slipstream over the wing resultin in a loss of lift and an increase i rolling moment, in addition to th expected yawing moment. In the cas of a jet airplane, only the yawin moment and the roll induced by ya will be present. This relieves th amount of lateral control require for a jet airplane for the engine-ou condition. Any airplane, swept o straight-wing, must have sufficien rudder and aileron control to handl the engine-out condition.

Crosswind Landing

During the approach on a crosswind landing there should be mor rudder and aileron control availabl than that necessary to hold an airplane in its yawed condition. B having an additional amount of control, proper corrections may be mad for any upsetting gusts. The additional rudder control can be used t increase momentarily the yaw jus prior to touchdown if it is necessar to reduce any existing crab angle. I the case of a swept-wing airplane, the rudder may be used effectively t obtain an additional rolling momen if such is necessary during the landing. Lateral control is, of course, necessary to lift the wing should it drop while near the ground. Both swept and straight-wing airplanes should have sufficient control to meet the crosswind requirements for which they are designed.

Conclusions

Some of the fundamental differences between swept and straight-wing airplanes have been discussed. Here it may be concluded that the low-speed handling characteristics are the major differences between swept and straight-wing airplanes. Other problems are common to both types and must be solved through proper design of the airplane.

The difference in the stalling characteristics of these airplanes must be considered carefully by the designer and should be understood fully by the pilots. ●

STRAIGHT and SWEPT

Wm. F. Ballhaus, Chief Engineer, Northrop Aircraft, Inc.

THE chief handling quality problems that arise because of wing sweep-back are:

- The tendency of the airplane to pitch-up abruptly at high angles of attack.
- A decrease in aileron effectiveness at high angles of attack.
- A large increase in dihedral effect at high angles of attack.

The pitch-up tendency and the decreased aileron effectiveness of swept-wings are caused by the outward spanwise flow of low-velocity air near the surface of the wing, an effect which increases in magnitude as the angle of attack of the airplane is increased. In the case of pitch-up, this low-energy flow tends to separate from the upper surface of the wing near the tips, rendering the tip portions of the wing ineffective compared to the apex portion. This results in a nose-up pitching moment.

If conventional trailing-edge type ailerons are located in this low-energy spanwise flow region, it can be seen that the aileron effectiveness will tend to decrease as the angle of attack of the airplane is increased, because of the increased severity of the spanwise flow with increasing angle of attack.

A swept-wing inherently shows positive dihedral effect even if the amount of "built-in" dihedral is zero. A simple explanation of this is shown in Figure 3.

When the airplane is sideslipping to the right, as shown, the relative wind strikes the left wing panel obliquely compared to the right wing.

Because of this asymmetry, the lift on the right wing panel is much greater than that on the left panel, thus creating a very large rolling moment to the left. It has been found that the magnitude of this rolling moment increases with an increase in angle of attack of the airplane.

A further consideration in the handling qualities of swept-wing aircraft is the effect of aspect ratio. In general, the higher the aspect ratio the more pronounced are the detrimental effects of sweep, because the spanwise flow effects are accentuated. On the other hand, highly swept-wing aircraft of very low aspect ratio introduce a directional instability problem caused by the severe sideflow effects on the aft portion of the wing and on the vertical tail. The directional instability of this particular type of airplane occurs only at very high angles of attack, and may or may not be readily controllable using the rudder, depending on how fast the rate of divergence becomes.

Specific answers to the questions asked by the Directorate, Flight Safety Research, are as follows:

- Maneuvers which may result in loss of control of swept-wing aircraft can be separated into two types: those involving the abrupt longitudinal pitching up and those in which sideslipping occurs when the airplane is at a high angle of attack.

The abrupt pitch-up tendency occurs during high G dive recoveries and high G turns. It is especially dangerous because a pilot's reaction time may be too slow to apply corrective elevator motion before a destructive G load has been imposed.

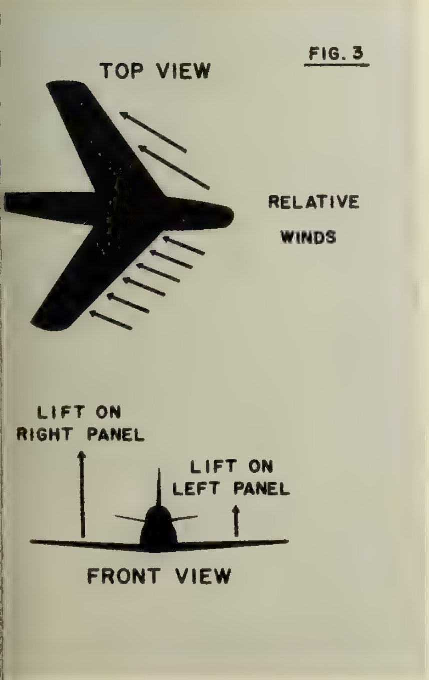
Examples of the second type of dangerous maneuvers are intentional sideslipping in the landing approach, and sideslipping when pulling high G normal acceleration. These maneuvers are hazardous because the sideslip creates a large rolling moment because of the high effective dihedral of the swept wing. This requires considerable aileron deflection to balance out, and leaves little additional aileron motion for margin of control.

- On multi-engine swept-wing aircraft, the loss of an engine on one side may or may not result in a serious control problem, depending on the particular design and the pilot technique involved. If the sideslip angle is allowed to become too large, the pilot may have insufficient aileron control to prevent the airplane from rolling, as explained above.
- The abrupt pitch-up tendency in high G maneuvers is probably the most dangerous characteristic of the swept-wing airplane as far as a pilot is concerned. The sideslipping maneuver can also be very significant in this respect, because of the possible loss of lateral control at low altitudes, say, during a landing.
- The permissible degree of sideslip will vary within large limits for each particular airplane. An arbitrary scale for intentional sideslips could perhaps be defined as follows: five degrees maximum sideslip when in the landing approach; 10 degrees maximum for any maneuvers at high angles of attack, and 15 degrees absolute maximum under any condition.
- Based on the above discussion, it is indicated that sideslip maneuvers would be more critical at low indicated airspeeds because of the associated high angles of attack.
- Recommended preventive or precautionary action:

With regard to the pitch-up tendency of swept-wing aircraft, it should be expected that the manufacturer provide sufficient alleviation, either in the form of aerodynamic fixes, control force or control deflection G limiters to prevent the pilot from inadvertently overstressing the airplane. Pilot indoctrination and training in this particular handling characteristic is, of course, an important aid here, but it may prove to be inadequate for some aircraft designs now and in the future.

With regard to sideslipping, it is recommended that a pilot avoid large sideslipping maneuvers in swept-wing airplanes. ●

FIG. 3



Fit to Fly

Man and machine. That's our winning combination. If either one of the two elements fails to function, it follows that the duo is out of business. The Air Force has always considered the human as the most important member of this dual combination, consequently, FLYING SAFETY has selected the following two articles on physical fitness for this all jet issue.

The fighter pilot is all alone. He is required to operate at extreme altitudes at high speeds, and regardless of the cause, if he fails to operate . . . that's all she wrote. However, physical or psychological malfunctions affect all air crewmembers, regardless of aircraft type or mission. Imagine if you can, the effectiveness of a B-47 bombing mission with any one of the three crewmembers tied up in knots with acute indigestion, for example.

Today's airman must be in shape for every flight. Being in shape means keeping fit but, if you are feeling under the weather, remember. . . . "He who treats himself has a fool for a doctor."

FLYING SAFETY is indebted to the Douglas Aircraft Company, Inc., for their contributions to the first part of this article.

YOU, as a pilot, should be familiar with certain factors affecting the human body. Knowledge of these factors will assist you to carry out your flight missions properly and in the most efficient manner.

Probably you've been exposed to quite a bit of this information previously. Most of it is contained in various medical publications but is not readily available or expressed in simple terms.

Just as there are restrictions on your airplane, there are restrictions on what you can do. You might say they were determined by design limitations practiced by the Almight when He built you. These are built-i and must be remembered just as we as those in your airplane. When all said and done, there is only one wa the two of you can function effe tively, and that is as a team.

The real purpose of this article to bring sharply to your attention th fact that you can put additional r strictions on your team. They a under your deliberate control, an you can't blame the Almighty or sc ence for failures occasioned by you own deeds or misdeeds.

Human Restrictions

Restrictions on the human bod can best be expressed in terms of th lack of power to overcome physica stresses. These vary depending upo environment. Flying presents a num ber of stresses which are found onl in this particular field. One grou is classified as natural stresses b cause they are built-in and are n induced by our own efforts. Let examine these stresses and see ho they affect your ability as a pilot.

Exposure To Altitude Withou Oxygen—We're not going to delv too deeply into this subject. It's continuing subject with us and we' be hitting it again in FLYIN SAFETY.

However, just remember that oxy gen is as necessary for the function ing of the human body as it is fo the combustion of fuel. Your bod uses oxygen in much the same fash ion by combining it with a carbo compound to produce energy, an gives off carbon dioxide as a waste.

Be sure to review your technica directives on the use of oxygen a frequent intervals and carry them ou religiously. An occasional review o T. O. 15X-1-1 is a worthwhile mov on your part. It contains some might good stuff.

Exposure to Carbon Monoxide—Carbon Monoxide, when absorbe by the blood, can be extremely dan gerous, as we all know. It reduce the amount of hemoglobin availabl for carrying oxygen to the tissue and makes the transfer of whateve oxygen is present difficult. It is absorbed by the blood over 200 time more readily than oxygen, and i more difficult to dislodge from th blood stream.

The danger of carbon monoxide especially in combination with th lowered partial pressure of oxygen a altitude, cannot be over emphasized.

FLYING SAFETY covered the angers of carbon monoxide poisonig in the May 1954 issue. If you idn't read it, better get a copy and ig in right now.

Exposure To Rapid Altitude hanges—Rapid pressure changes cidental to changes in altitude prent no problem if you are in good hysical condition, since normal learing of the ears will permit balncing the pressure between the middle ear and the outside air. The probm arising from exposure to rapid ltitude changes when flying with a evere cold may well come under e category of "asking for it."

Exposure To Noise and Vibraon—Noises in aircraft are derived rincipally from the propeller, exaust, moving parts of the engine and erodynamic sources. Noise intensity measured in decibels. Research inicates that a noise level of 116 deciels, when sustained for over a peiod of six hours for eight successive lays, may be of sufficient intensity to ause irreparable hearing loss.

Helmets, earphones and earplugs ll have their place and certainly do elp but there's no denying that exessive noise over protracted periods f time, causes a lot of fatigue. Keep hat in mind and remember that a ouple of mills churning in your ear an slow up reaction time plenty.

Exposure To Motion—Some peole tend to become airsick easily. thers are never bothered. There's o one single cause for all cases. The ymptoms are very clear and unmisakable. If you are susceptible, you vill learn for yourself what your est course of action should be, what ood items to avoid and how much of vhat motion you can take. Consult our flight surgeon and together you an work out the best plan for you.

Exposure To Visual Disturbances—There are a number of disurbances and distortions that can ccur during flight. Haze, color disortion, motion parallax and vertigo re familiar to all pilots. Also, cerain optical illusions such as those aused by lights reflected from water or lights in unsymmetrical patterns on the ground can cause confusion and disorientation. The only answer is "use those instruments!"

The Self-Induced Stresses

Exposure to the following self-induced stresses is within your control. Read 'em and remember 'em. It's your neck that's out, and, quite possibly, several others may be on the block with it!

Inadequate Rest—We don't need to dwell on this one. You know how much sleep you need. If you deliberately skip this one factor, brother, you're looking for trouble. In case you don't know, lack of sleep reduces your efficiency, and this in turn reduces your tolerance to stresses and slows reaction time.

Colds—You've been warned many, many times about leaping off into the blue when a headcold is raising hob with your system. We've classed colds under self-induced stresses because they mean much more in flying than in your ordinary terrestrial existence. The cartoon depicts just how cold germs louse you up when flying.

Alcohol—It shouldn't be necessary to harp on this subject that's so near to the hearts of so many. Alcohol slows down mental performance and reaction time, and it takes many hours for its effects to wear off. In modern aircraft the jockey with slow reactions may well be the dead one. Either join the AA's or play it real cool. Remember, *you* are the worst judge of the effects of alcohol upon your system and perhaps little realize what it does to your fitness.

Poorly Controlled Emotions—An untroubled mind is one of the greatest assets you can have. This is especially true when you consider the mental tasks and reactions required of you while flying. With split-second tasks to perform you may find yourself really behind the eight-ball if you have been flying along worrying about your finances, love life, mother-in-law or other equally disturbing conditions.

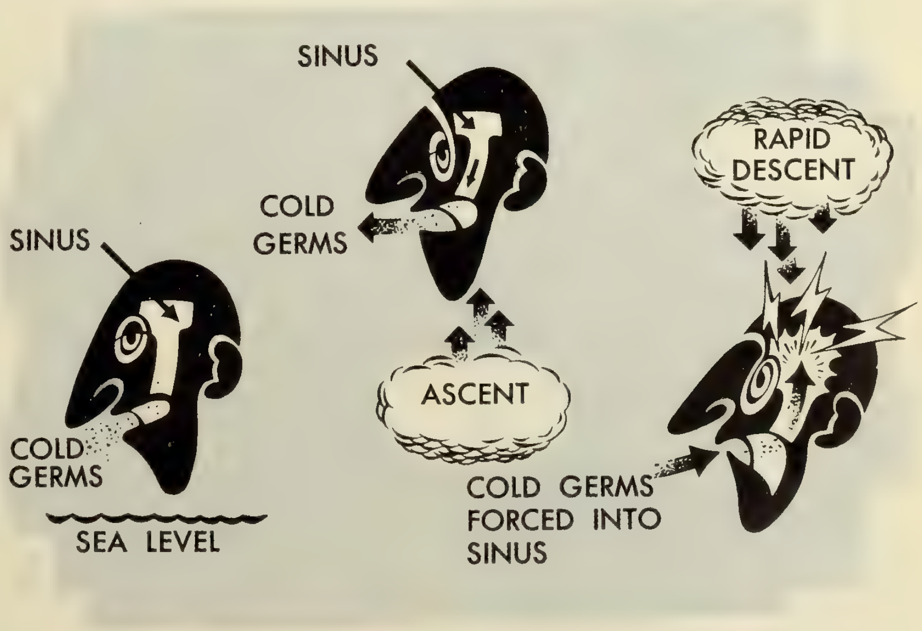
If your problems seem too great for you to solve, if you should worry constantly, you'd better take them to your banker, lawyer, doctor or chaplain. It's a cinch you shouldn't fly under mental strain. It leads to distraction from your normal functions, doping-off and if continued, to a case of psychoneurosis. Then, if you haven't fouled-up enough in the meantime to need an undertaker, you'll probably require the services of a good psychiatrist.

Exposure To Accelerations—There are four kinds of accelerations that pilots may expect to encounter:

★ Moderate G lasting for some time. This is the kind encountered in pulling out of a dive (aircraft, that is). This causes the blood to be thrown into the lower part of the body, and if it lasts long enough, the heart does not get enough blood to keep up the circulation. Black-out may result.

★ High G of short duration—less than a second. This is unavoidably built into the ejection seat in order to get a trajectory that will clear the empennage. Position yourself correctly prior to an ejection and there's no sweat on this one.

★ Sudden forward deceleration. This is encountered in crashes. The threat from this kind of deceleration is the chance of developing a gunsight complexion. Proper use of the shoulder harness takes care of this.



★ Tangential G of short radius. This is encountered in tumbling and buffeting. We can't give too much of an answer on this one, yet! Apparently not too severe unless the blowtorch gets pretty far gone.

Upset Stomach—This condition may vary from a mild tummyache to one accompanied by excruciating pain. Flying should not be attempted when suffering from this condition, since your efficiency and tolerance to inherent stresses will be considerably lowered.

Distension of the stomach and intestines with gas can be the cause of these symptoms. Avoid gas-forming foods especially if you are going upstairs. If you want to know what gas-forming foods are, see your long-suffering flight surgeon.

Smoking—There is one very sound reason why smoking can reduce the fitness of the pilot. The carbon monoxide resulting from incomplete combustion of the tobacco is the same as that which comes from the engine. The combined effects of the carbon monoxide and reduced oxygen at altitude can be harmful.

Remember, too, that excessive smoking can affect your night vision a great deal. The old depth perception can really get knocked off center if you go charging through the black of night, leaving a trail of tobacco ashes behind.

One last thought on tobacco. Maybe this doesn't apply to you, but it could! Many pilots have been known to yank off the oxygen mask long enough for a quick smoke. Figure it out. Mix one faulty regulator (leaking type) with one match (lit) and step clear! It has happened.

Heat and Cold—We could write reams on this subject but for the sake of the record we'll only say: Dress for the occasion. Uncle has invested a lot of dough in developing and procuring adequate flight clothing to meet the demands of practically every clime. When you are issued gear for protection, learn the reasons for it and get familiar with its use. You can't keep fit if you let yourself get exposed to uncomfortable degrees of heat or cold.

Empty Stomach—Food to the human body is like fuel for an engine. Fortunately, the mechanics of energy conversion in the human body do not require a continuous supply of food. Your body also has the ability to store up reserve energy permitting you to function between "refuelings." To function efficiently however, you must maintain regular meal schedules — preferably on a three-meals-a-day basis.

The reason for this is simple. If you allow too much time between meals, your potential energy leve drops below that required for your efficient operation before you refuel your engine again.

To boil all of this down, just remember that important stresses affecting pilots have been covered briefly. This information has been offered to impress upon you that:

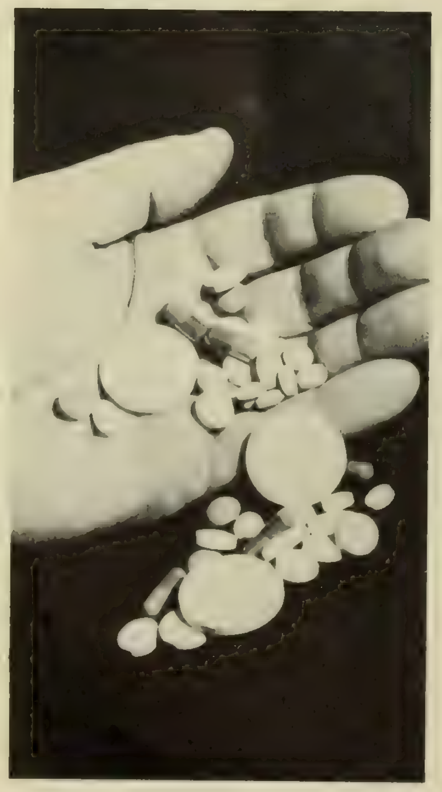
- Stresses exist which are detrimental to flight safety.
- Other stresses may develop as a result of your failure to maintain physical fitness.
- These stresses are not only detrimental individually, but their effects are also ADDITIVE, and as such may result in the failure of your mission and may even cost your life.

To quote that well-known Ground Safety cliche, "The life you save may be your own." Play it cool, brother, and stay loose.

★ ★ ★

Who's YOUR Doctor?

Col. H. G. Moseley, USAF (MC), Chief, Medical Safety Division
Directorate of Flight Safety Research



IT WAS A clear morning. The kind of a day that makes you want to fly. The sky was blue and the wind was little more than a warm breeze. A wonderful day to be alive.

The captain was being very careful with his flight planning. He cross-checked the strip map against the latest Radio Facility Chart. Ranges were changing rapidly these days and he had discovered early in his career that one could never depend solely on a map.

Then he examined the NOTAM file. Nothing to worry about. One en route air base reported construction on runway two-four and six. One range was carried as unreliable. No sweat. It would be VFR today.

He carried the form 175 into weather. The forecaster was busy getting a C-124 crew squared away so the captain studied the prog charts and mentally selected an altitude that looked favorable. In a few moments the forecaster was finished with the Globemaster pilots and turned his attention to the captain. This was an easy clearance. A very few thin scattered alto-cumulus at 20,000 and nothing else. Scrawling his signature on the forecast, the weather officer said, "Good Luck. See you later," and turned to the next crew.

The captain spent another couple of minutes rechecking his flight plan. Everything appeared okay. He had no doubts as to his personal ability as a pilot but he did have a healthy respect for his aircraft, and this T-33 as not as forgiving of poor flight lanning as a reciprocating aircraft ith large fuel reserves.

Picking up the carbon copy of the learance, he walked out to his plane. gain he checked carefully. The mahine was clean. The crew chief went ith him as he made the preflight.

"Everything looks okay," he said the sergeant.

"She's a good one," replied the rew chief as he helped the captain djust his parachute.

The sergeant said "she" subconciously as men have always said she" when they spoke of fine ships. nd she was a good plane, down to very flush rivet, down to the strength nd precision of every stringer and ormer. She should be good; thouands upon thousands of manhours ad gone into her perfection, and ow for hundreds of hours she had arried her pilots safely and comortably around the country.

This morning she was ready for nother mission. That this was to be er last flight was not her fault. The aptain had wilfully ignored one vital heck. As a result, both he and "she" vere destroyed. One moment they vere cruising straight and serene. Then they entered a gradually steepning dive. There was never a change of power setting; not even the simplest attempt to alter the tragic ourse. Human control had lapsed.

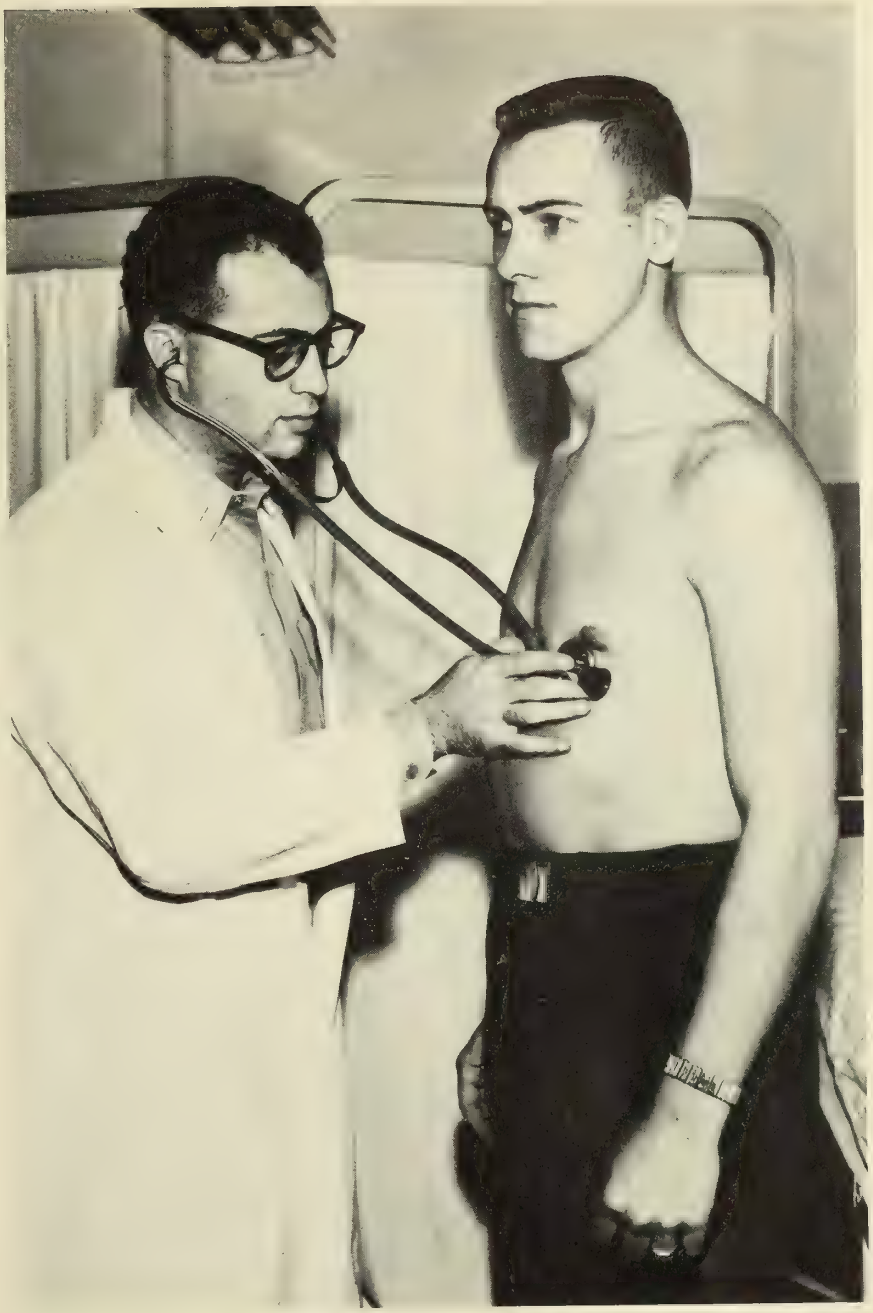
To understand this strange oversight one must go back a year or two. That was when the captain first noiced that something was wrong. It was evening and he was sitting down reading the paper when it happened. If he had been asked to explain what was wrong, he probably would have said he felt something turning over in his chest and that he felt a slight choking sensation. After a few moments it was over, completely gone. Outside of a bit of perspiration on his brow he was perfectly normal. He did not think anything more of it. Not just then anyway.

However, as time went on he began to have additional attacks of this strange sensation in his chest, and twice in recent months he had blacked out completely for a few moments when these spells came. He was afraid that one might happen some day when he was driving. He may have been afraid to think what might happen if he had a spell while flying. Unfortunately he found out. It was too late then.

What is inexplicable is that he never went to his Flight Surgeon. Even on his annual physical examination he denied any trouble or abnormal physical condition. It may be that he thought his trouble insignificant. It is more probable that he was afraid the doctor would ground him. And that is what would have happened in this case.

The Flight Surgeon would have told him that he had trouble with his heart, and probably given it some name such as "paroxysmal tachycardia." How long this man would have been grounded we do not know. Perhaps permanently. Certainly until the cause could have been found and eliminated. One thing is certain, the Flight Surgeon would have saved him.

Fortunately, there are only a few pilots who delude themselves into thinking they can fly while seriously ill or while suffering from an unpredictable physical hazard. However, between serious or hazardous illness and good health, there lie a variety



". . . the strength of the Air Force depends on healthy and willing personnel. Self appraisal of illness or injury has never proved to be of any value to either the Air Force or the individual."

of conditions and a multitude of strange cases.

For our second example we have selected a true story of a lieutenant with a headache.

This case took place in one of our southwestern states during the winter. The lieutenant, who was a new arrival at the base, was living in an off-base cottage of dubious elegance but which did suffice as a temporary shelter for the officer and his family.

The weather was cold, and for several days it had been necessary to keep the windows closed and an open gas heater burning day and night.

For several mornings the lieutenant had noticed a headache when he arose. It was a rather nasty headache associated with some dizziness, but it usually left before noon. He wondered what his trouble was and thought perhaps it was due to a cold that had been plaguing him for about a week. He was partially right at that.

To help in knocking out the cold, he procured some anti-histamine pills. He had heard and read many cure-all claims for this type of self-medication. Now he was taking one of these pills every four hours. He wasn't sure if they helped very much or not. He did know, however, that he was not feeling very well.

Here we can see an accident just looking for a place to happen. There was one more significant item building up toward the accident in which he was to be involved. That was his oxygen mask. It didn't fit very well. In fact, when he turned his head it leaked rather noticeably.

This officer was a walking medical museum of reasons why one should not fly. To start with the simplest of his afflictions, the cold from which he was suffering would have been reason enough to ground him. Further complications evolved around a serious case of carbon monoxide poisoning. We'll get to that a bit later. It's enough to note here that the lieutenant ran out of luck all of a sudden.

Incredibly, this pilot, saddled with a cold, under the influence of hypnotic drugs, suffering from carbon monoxide poisoning and with an ill-fitting oxygen mask, started his jet and took off for a high altitude mission.

What is still more incredible is that this lieutenant flew to over 30,000 feet, cruised there for a while and then brought his plane down for a landing. He was groggy and bleary-eyed to be sure but he still possessed the fundamental rudiments of flying technique. He landed the plane short and wiped out the gear. He, himself, was unhurt.

It was not until the next morning when the effects of his various poisons had worn off, that he was mentally alert enough to grasp the seriousness of his previous day's conduct and probably wonder at whatever Guidance it was that brought him back okay.

From a medical viewpoint, whether or not an individual should fly with a cold depends on many factors. However, in general it may be said that if the cold is still mild there will usually be no ill effects from flying. But if the cold is severe, and especially if it is of the type known as a head cold, serious consequences may occur, particularly if the flight is conducted at high altitude.

Pilots have suffered serious ear conditions from flying with a cold, and there have been cases where pilots and crewmembers have experienced such pain from sinus trouble during rapid descent that it was difficult to maintain consciousness.

The actual decision as to whether or not the lieutenant should have flown with his head cold should have been made by the Flight Surgeon. In this case, however, the cold was the least of his physical troubles.

The treatment the lieutenant was giving himself was a far greater hazard to flying than the cold itself. You probably have heard the saying that "he who treats himself has a fool for a doctor." It's just a dangerous business. That body of yours is a delicate and complex machine.

Some of the so-called cold pills contain a drug which is medically known as anti-histamine. This is the type the lieutenant was feeding into his system. For some people, particularly those whose colds are associated with allergies or hay fever, this type of treatment may be very beneficial. However, like all drugs it should be taken carefully. Furthermore, the anti-histamines have an added property which is known as being hypnotic. In other words, it causes drowsiness and lack of alertness.

Even under normal conditions those drugs should be taken judiciously and under the supervision of a physician. Remember too, that any anti-histamine is not compatible with flying. Current regulations state that no one may fly within 24 hours after taking such medication.

You'll remember that our lieutenant's troubles first started from series of headaches. The man himsel might have been able to realize th cause of his troubles if he had though back to his cadet training days an recalled something about the lecture on the dangers of carbon monoxide He might have remembered that carbon monoxide is a toxic gas an that even a small amount, such a may come from incomplete combustion in a faulty gas heater, can produce dangerous physical symptoms

Certainly he should have bee aware of the dangers of inadequat ventilation in his own home. And, i he forgot all of this, he certainl should have remembered the symptoms of carbon monoxide poisoning We all had it drilled into us tim and time again. Remember them Headache, dizziness, weakness, sometimes nausea and vomiting and then if too much is inhaled, stupor, unconsciousness and finally, death.

The reason that carbon monoxid is so deadly is that it may be take up by the blood very easily. In fact it is absorbed by the blood over 20 times more readily than oxygen. I doesn't take long to put one out o the picture.

What is particularly hazardou about carbon monixide poisoning and flying is the effect of altitude As in the case of this lieutenant, a individual may have only part of hi blood saturated with carbon monoxide and still be able to walk around although not feeling too well. However, when pilots go to altitude, the encounter conditions where there i less and less oxygen and less atmospheric pressure to push the oxygen into their blood. When the reserve of oxygen carrying power is compromised by being partially occupied by carbon monoxide, stupor or unconsciousness may occur very easily.

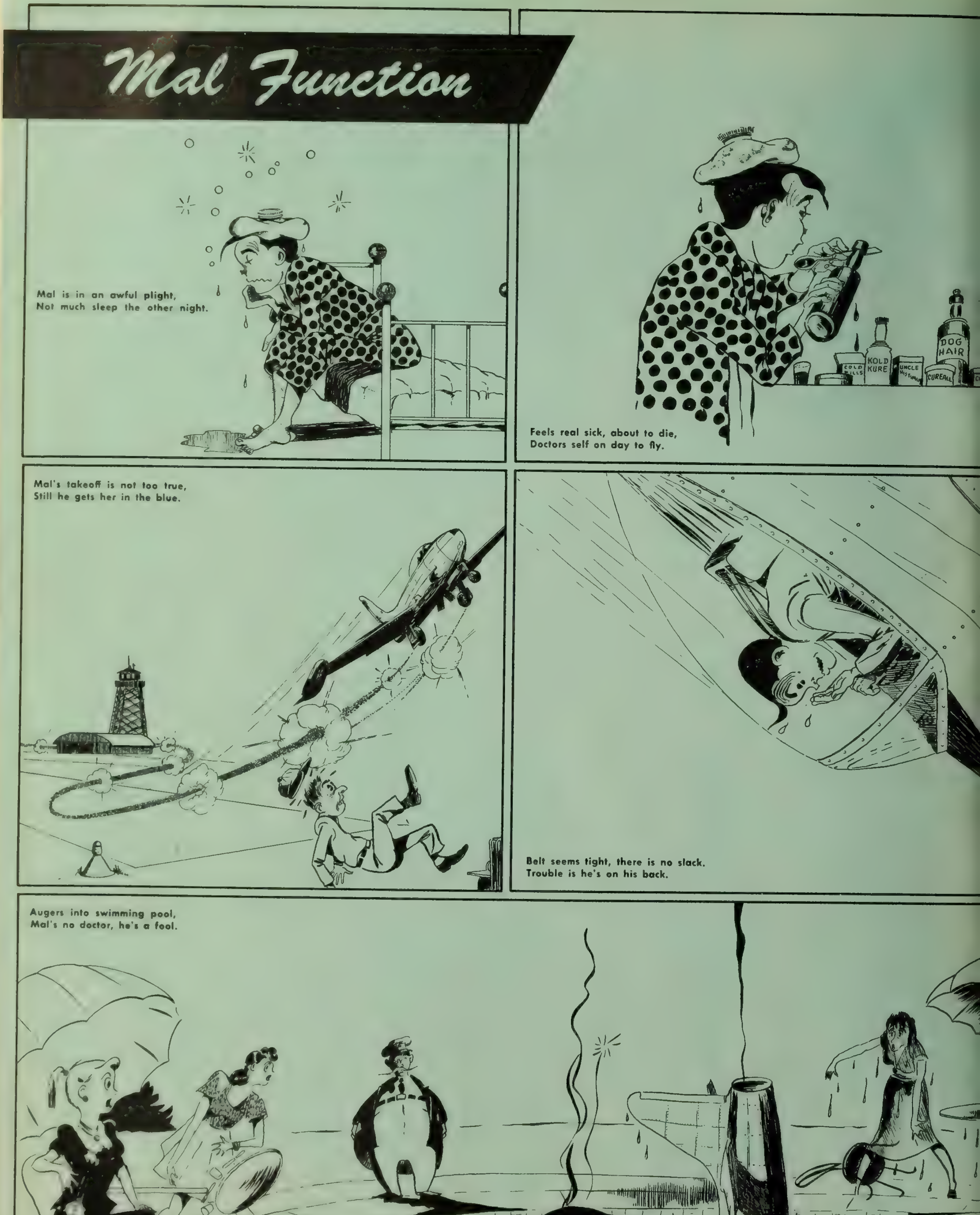
The striking thing about all accidents attributable to poor physical condition is that they are 100 per cent preventable. Maintaining good physical condition and giving reasonable concern to health is such a biologically sound principle it's strange that some people attempt to evade it.

No one will ever be censored for turning to the Flight Surgeon in times of doubt. On the contrary, the strength of the Air Force depends on healthy and willing personnel. Self-appraisal of illness or injury has never proved to be of any value to the Air Force or the individual; it has cost us both lives and dollars. ●

1955

No question,
but that this fair damsel is
planning to start the New Year off
with much fanfare and gaiety. But the day
after the ball it's a pretty good bet that she'll be
equally firm in resolving—Never Again! From here
it looks as if this applies to some of us fly-boys, too.
We start off the year with the firmest intentions of making this a trouble-free year, only to see those good
intentions shattered through carelessness, poor techniques and procedures and lack of a professional attitude toward our jobs. And no one looks good decorating a statistics page. So this year let's make one
resolution and stick to it...shoot for a record-low accident rate in 1955. Remember
—accident prevention starts
with YOU!

Mal Function



Mal is in an awful plight,
Not much sleep the other night.

Feels real sick, about to die,
Doctors self on day to fly.

Mal's takeoff is not too true,
Still he gets her in the blue.

Belt seems tight, there is no slack.
Trouble is he's on his back.

Augers into swimming pool,
Mal's no doctor, he's a fool.

★U. S. GOVERNMENT PRINTING OFFICE . . . 3116

1305
YS

FLYING SAFETY

UNITED STATES AIR FORCE

FEBRUARY 1955

THE LIBRARY OF THE
MAR 7 1955
UNIVERSITY OF ILLINOIS

BIG
BRUTE
technique

PAGE 12

FLYING SAFETY

VOLUME ELEVEN NUMBER TWO

Department of the Air Force
The Inspector General USAF
Major General Victor E. Bertrandias,
Deputy Inspector General

Brigadier General Richard J. O'Keefe
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

Maj. Philip A. Watson, Jr.
Acting Supervisor of Flight Safety
Publications

Editor
Maj. Joseph P. Tracy

Managing Editor
Capt. John H. Moore, Jr.

Associate Editor
Major Perry J. Dahl

Art Editor
M/Sgt. Steven Hotch

Production Assistant
T/Sgt. Carl E. Fallman

Staff Photographer
T/Sgt. Nicholas Shekitka, Jr.

Circulation Manager
T/Sgt. G. J. Deen

CONTENTS

	Page
Crossfeed	1
Whoa Fans	2
Reversal in Flight	5
Well Done	7
Anymouse and his hairy tales	8
Shift to High	10
Big Brute Technique	12
Well Done	17
Smoking Facts	18
Rag Drag	20
Keep Current	24
Designing the Office	26
Concrete Ski Trails	28

Latest tow target techniques in both the T-33 and the "hard wing" F-86F are discussed on page 20, this issue.

SUBSCRIPTIONS

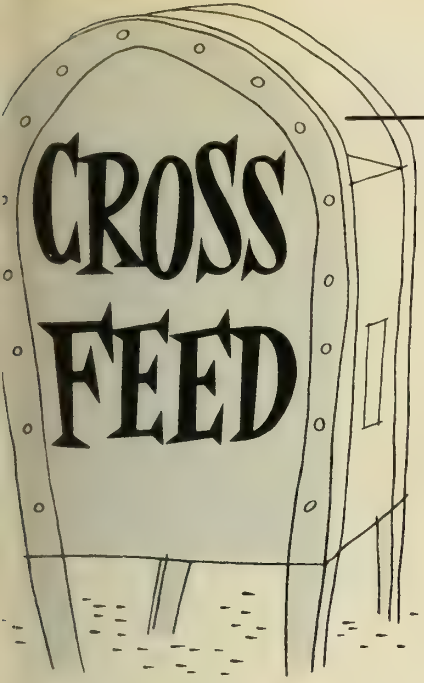
FLYING SAFETY magazine is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished.

* * *

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in FLYING SAFETY magazine. Contributions are welcome as are comments and criticisms. Address all correspondence to the Editor, FLYING SAFETY magazine, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

LETTERS TO THE EDITOR



Incident Reports

Two recent incidents have occurred at this base that may be of interest to pilot personnel at other bases.

The first involved a malfunction of a supercharger in a B-25 aircraft due to heavy deposits of sludge. The accumulation of the sludge was due to pilots' failing to exercise the superchargers on each flight, in accordance with Dash One operating instructions. It points out graphically the result of a small omission by each pilot, over a period of several weeks. The supercharger should be placed in the high blower position for fifteen minutes. for each two hours of operation in the low position, and vice versa. The mixture and power settings to affect this change are listed in the Dash One operation instructions. Also, in the event of a mental omission on some flights (IFR weather conditions have occasionally allowed us all to forget), then the superchargers can be exercised on high for 30 seconds and then back to low for 30 seconds, repeat this operation five times. Probably, this alternate procedure is not as effective (it is listed in the Dash One postflight check), but it is better than not exercising the supercharger controls at all, allowing sludge deposits to accumulate and accumulate. It's a repeat of that old story — know the correct procedures, and then faithfully follow them.

The other incident involved GCA's radar channel failure, during low ceiling and visibility conditions. So many of us utilize and depend upon radar control, either approach or GCA, that we are prone to forget that all radar is a series of wires, cables, tubes and rectifiers, and consequently is subject to failure. "Back up" channels are available, but these can fail simultaneously also, as they did recently at this base. The aircrew had a few tense moments orienting themselves, because they had relaxed their vigilance after being told they were in "positive radar contact." The tense moments were further intensified by precipitation static that retarded reception of the low frequency range. Forwarding this tale is intended to remind all pilots that radar is subject to periodic failure and we must have complete knowledge of the emergency procedures to be followed in the event of radar or radio failure.

Capt. Joseph J. Walsh
FSO, Griffiss AFB, NY

Words of wisdom on the B-25 supercharger and the orientation problem during a radar approach. Incidentally, don't miss the article entitled "Shifting To High," concerning the single-stage, two-speed supercharger, starting on page 10.

★ ★ ★

Safety Record

Since 21 July 1952, the 512th as of 22 October 1954, has flown 10,744 accident-free jet fighter hours. It is interesting to note that during the period 21 July 1952 through 10 November 1953, the squadron was flying F-84E Thunder-jets with one-half of the pilots having to be transitioned into this aircraft and upon receipt of F-86F Sabre-jets it was necessary to transition 26 pilots who had never flown Sabres before. Three pilots had previous F-86 time.

The reader may wonder how this enviable record was accomplished. First it was felt that some method of standardized briefing procedure was needed for the pilots. This was accomplished to insure that all flights were thoroughly briefed and debriefed by originating separate mission cards for all flight leaders. Next, due to inclement weather surrounding our English local flying area, special emphasis was placed on insuring that each pilot was familiar with the requirements of a solid instrument training program. Link training was stressed as well as a thorough refresher of all instrument flying regulations.

Another basic reason for the success of this unit is the healthy attitude toward new personnel entering the squadron. Each man is welcomed heartily and made to feel he is as important as the oldest member of the squadron. On the other hand the more experienced pilots maintain an open mind for suggestions from new people and often their ideas are made an integral part of the operation.

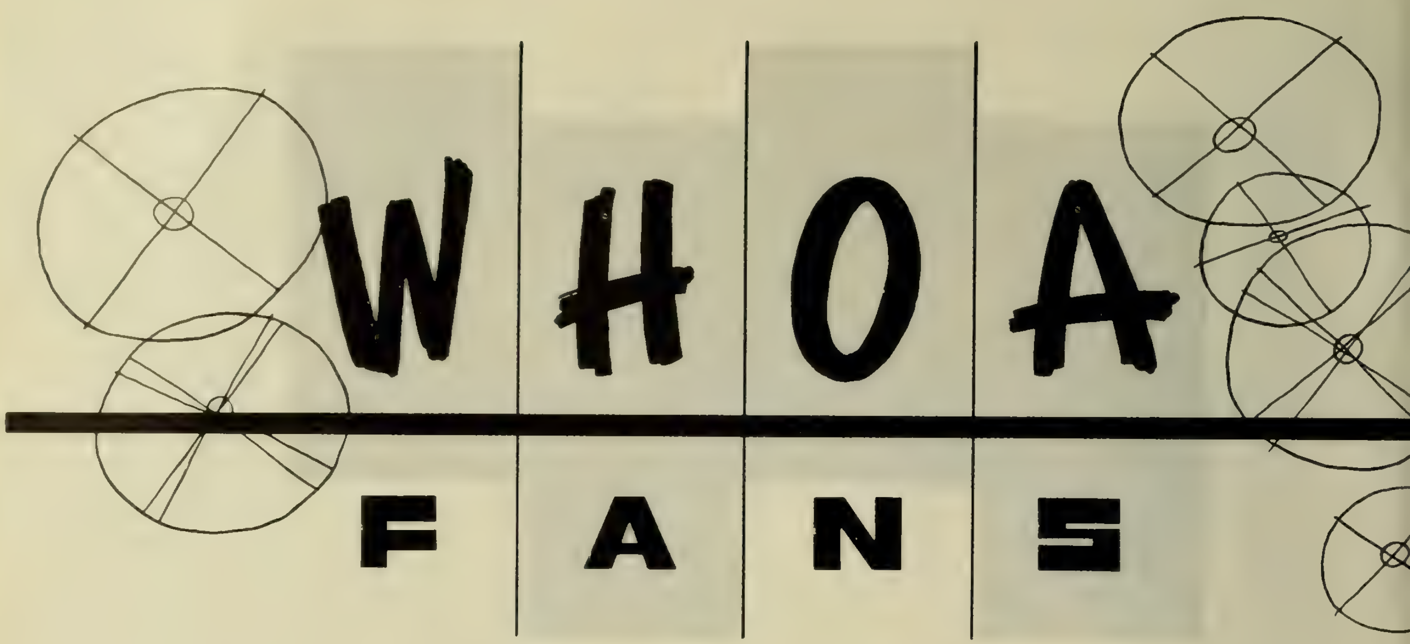
Each pilot is proud of the fact that he is a professional and is willing to assume the responsibility of his position.

To say that any one section of the squadron is responsible for the successful completion of the mission would be impossible; however, without a top-notch maintenance section our flying safety record would never have been established. Fortunately, for the 512th, the maintenance section maintains an exceptionally high level of espirit de corps. As the new men enter the squadron, they are sent through an OJT program which enables them to become familiar with maintenance procedures used. Our engineering officer, Lt. George Erema, is well qualified both as a pilot and in his field of maintenance. After his men complete inspections or any maintenance requiring a test hop, he often assumes the responsibility to test the aircraft and clear the discrepancy before turning the airplane over to the squadron.

The squadron Commanding Officer, Lt. Col. Frank M. Haynie is always happy to discuss the subject of flying safety. Combined with 3800 hours of flying time, Col. Haynie previously commanded a maintenance squadron enabling him to possess first hand knowledge of maintenance problems. Upon surpassing the 10,000 hours of accident free flying time, he was quoted as saying that "the 512th's motto from now on will be double or nothing." Our goal is now 20,000 accident-free hours.

512th Ftr. Day Sqdn.
406th F-I Wing.

WHOA FANS



Here is an explanation of the latest innovation designed to prevent inadvertent reversals. It's known as "lift-to-reverse."

PILOTS find reversible propellers mighty handy in any season, but the reversible prop really shines when winter's ice, snow and slush cut the bite of normal brakes.

Any motorist who has ever driven in severe winter weather knows what happens if you stomp automobile brakes on an iced-up road. However, the "whoa!" action of reversibles has nothing to do with the conditions of the runway surface, slippery or dry.

Reversible propellers are mighty handy devices, but it has been quite an uphill job to design a foolproof mechanism, which brings us up to the main point of this article.

The Air Force's latest innovation in the field of back-up fans is a device that practically eliminates the possibility of unintentional manual reversing. This is accomplished by the introduction of a lift-to-reverse method of throttle operation. The system, as now approved, is in keeping with the basic instincts of most pilots. It's a natural movement to pull anything aft to stop.

Obviously a pilot must control his aircraft, and he'd prefer to do it with a minimum of gadgetry in between his fist and the plane's response. As nearly as possible, he wants positive control in his own hot mitts.

Unless a system has been proved perfectly reliable, he is dubious of complicated machinery in which "the music goes down and round—and it comes out here." And who's to say him no? After all, he flies the aircraft.

In line with that thinking, you'll soon be seeing these new throttles on C-123Bs, C-130s and many other planes designed in the future which have reversing props. These will include turbo-propeller jobs coming up which lend themselves perfectly to this new system.

The big idea behind these controls is to make it almost impossible for a pilot to reverse *without being completely conscious of the fact.* These controls are a built-in design to prevent inadvertent reversals. Mechanically simple and sturdy, they end reliance on such potential trouble makers as scissor switches in the landing gear and solenoids in the throttle console or pedestal.

To reverse the fans, the pilot must vertically lift his throttles approximately an inch over a positive metallic stop. Pulling back from the forward position, the power levers come to a complete, definite halt. There's no mistaking it and there's no sliding or bumping over this obstruction. The only way to continue into reverse is to lift the throttles along the path of a completely inclosed cam track. When the driver has done that, he is bound to know that he is pulling into reverse.

This gives the pilot manually-powered, mechanically-simple, one-man, single-handed control over reversing at all times. And "at all times" can get important when a split second decision must be made.

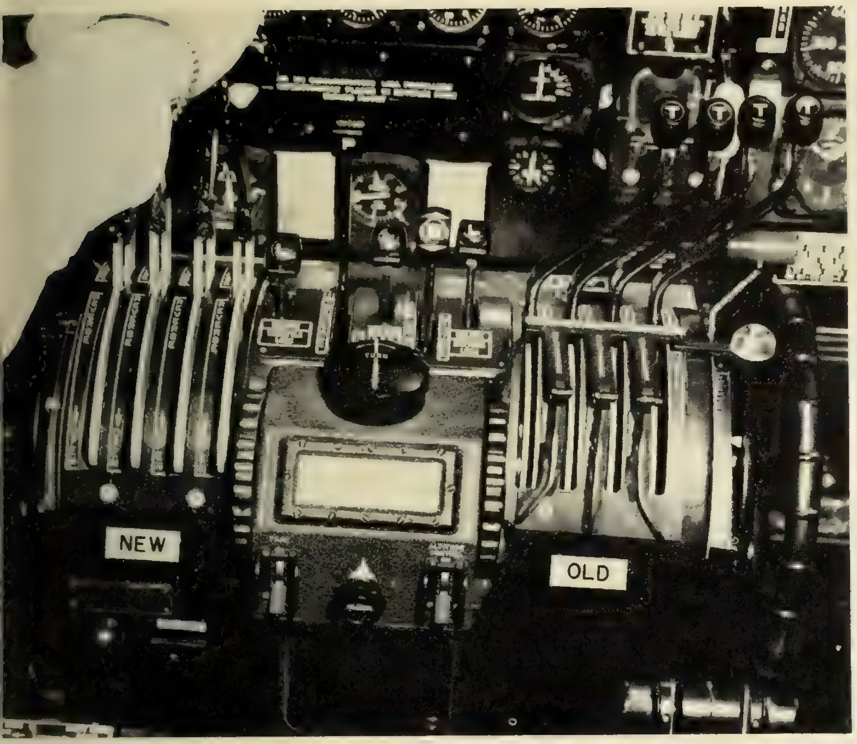
Furthermore, if reversing in the air for special purposes is ever approved by the Air Force, these throttles will do the trick without modification. Meanwhile, experts contend, this outsized solid-stop, vertical-lift provision will keep pilots from unwittingly reversing while airborne.

Although just now coming into field use, the lift-to-reverse idea has been in the mill for many a long year. As early as 1951 at the Wright Air Development Center, where the bugs were ironed out, propeller lab technicians thought the "reverse sense" throttles in use could be simplified for greater efficiency.

Pilots' reports of inadvertent reversals gave strong impetus to the hunt for something better.

The propeller laboratory initiated a study for a design that would be simple to manufacture and maintain and would permit lift-to-reverse control from pilot's or copilot's console.

The combined talents of WADC



Using the new arrangement, left, in order to reverse the propellers all that the pilot is required to do is lift the throttles approximately one inch and move them back into the reversing position.

pitched in on a high priority basis, and after much study, experimentation and testing, these basic standards were agreed upon:

- A simple mechanical device to be manually powered.
- A near vertical lift of one and one-eighth inches to move back into the reversing position.
- Mandatory use of an inclosed cam track.
- Maximum lift of one pound per lever for single controls, and of three pounds per lever for double controls.
- A power knob configuration in which four throttles would feel like a comfortable solid round bar in the hand, putting one finger around each knob.

Douglas designed an experimental unit which was thoroughly flight tested in a C-124. After several modifications, test pilots expressed satisfaction with the configuration.

Boeing also built a model and gave it a thorough workout on a C-97. Literally hundreds of reversals went into these tests.

Finally, basic requirements were approved by the Air Force and were written into the Handbook of Instructions for Aircraft Designers.

How throttles progressed to this point should interest mechanics as well as pilots. When reversibles were first introduced, they were operated by the old conventional throttle. To get maximum results, either in forward or reverse pitch, you shoved the controls forward.

The aircraft response, of course, was completely opposite for identical throttle settings, depending on whether you were in forward or reverse. Kids who built soap-box "cars" in the early days discovered a delightful trick. They reversed the steering wheel—turn it right to go left and vice versa. Then they put an unsuspecting victim in the contraption and shoved him down a steep hill. The results were always hilarious — and often disastrous.

Probably the first pilots to use reverse props with standard forward throttles felt something like these victims, although forewarned. Which reminds us of one we witnessed back in 1930. The hapless soul in this little caper was flying an old Navy Vought bi-plane, complete with a P&W mill, bird cage wires *and* an experimental reversible prop.

The pilot came charging up to the field one day at about fifteen feet, saw he was going to undershoot and poured on the coal. Unfortunately he forgot that he'd already reversed the blades. The immediate and end result was instantaneous.

The poor old Vought descended vertically as power was applied, struck a fence amidship and broke in half. Splinters and fabric flew in all directions, and as the dust settled, the pilot came scrambling out of the wreckage, unhurt physically but deeply wounded spiritually.

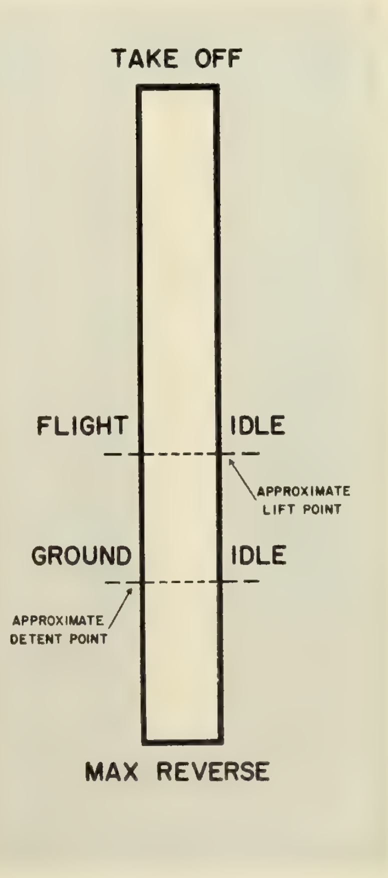
However, enough in retrogression.

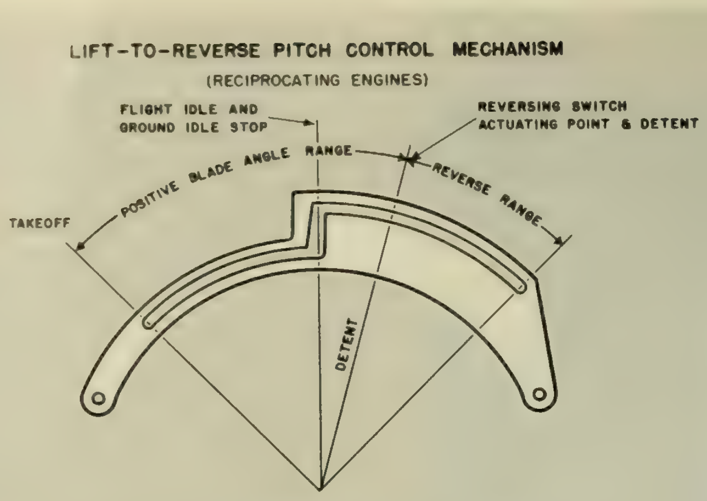
As we all know, pilots guide their aircraft on the ground by jockeying the power knobs. On takeoff, if you are yawing to the left, advance the left throttle. When in reverse with the old throttles, you had to do exactly the opposite to correct left yaw.

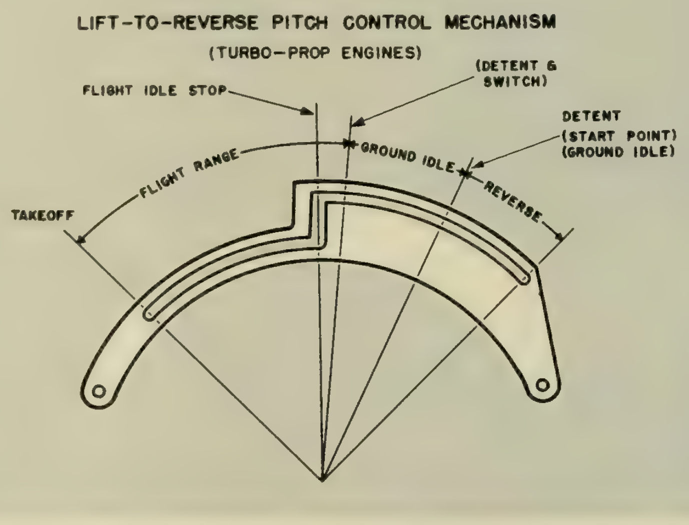
Certainly this was no good—diametrically opposed rules to remember for throttle steering on the ground.

Why not make this system consistent—forward for giddy-up and back for whoa? Or, for the non-horse types, just push to go and pull to stop. Reversible props were just a special and added bit of throttle whoa, and as such belonged toward the rear. It wasn't very long before such an arrangement was worked out. This one did the trick. Even the fist action in jockeying the knobs worked

The drawing indicates approximate throttle positions on the lift-to-reverse quadrant.

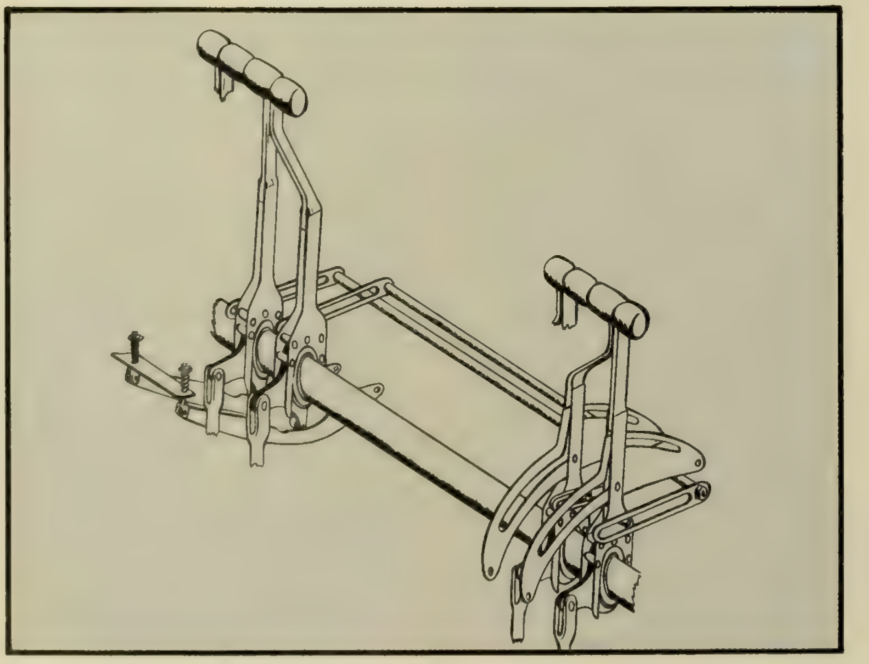



LIFT-TO-REVERSE PITCH CONTROL MECHANISM
(RECIPROCATING ENGINES)
FLIGHT IDLE AND GROUND IDLE STOP
REVERSING SWITCH ACTUATING POINT & DETENT
POSITIVE BLADE ANGLE RANGE
REVERSE RANGE
TAKEOFF
DETENT



On reverse control mechanism, the lift must not be more than ± 5 degrees from the vertical.

This diagram shows the current production configuration of the new lift-to-reverse sense throttle.



out the same in forward and reverse.

Refined, this system came to be known as "reverse sense throttles," and they were first used militarily on the C-74.

In this method, the forward part of the quadrant controls positive thrust, and the behavior is identical to that of the conventional throttle. Backward movement past the midpoint, however, trips the reversing switches, and increasing negative thrust is obtained as the power lever is pulled aft.

A "feel" detent is provided which the pilot recognizes as a signal that reversing has taken place. Hesitating at this spot for a one-two-three count permits the propeller to reach the reverse angle without overspeeding. The location also provides sufficient power to prevent stalling the engine.

It was necessary to add another measure to prevent reversals when airborne. A micro-switch was fitted into the landing gear strut scissor. When the strut was compressed, the switch operated and a solenoid in the cockpit quadrant withdrew a stop, permitting reversal. Thus one could only reverse on the ground—if all of these added works worked!

This reverse sense configuration had one weakness. If a pilot decided to abort a takeoff and the aircraft weight was carried by the wing, he could not reverse because the solenoid stop, actuated by the strut scissor, would not be withdrawn. An override had to be provided.

It was decided that such an override must be purely mechanical to guard against failure of the circuit, the solenoid or the scissor switch.

With such a reversing control the pilot could make a normal landing, and when the aircraft was on the ground, the throttles could be moved aft and reversing occurred.

It wasn't long after the reverse sense controls came into service that pilots started to depend on them. This dependence took the form of "crowding" the throttles, or "riding them down" on the landing; i.e., keeping them against the stop so they could be pulled into reverse as soon as the solenoid was thrown.

In some aircraft, even today a few pilots will crowd the throttles and then override the stop by cooperative action between the pilot and copilot. Such a landing is made by the copilot pulling the override when he hears the tire bark on the runway. The pilot, having crowded the throttles, quickly moves them aft, and reversing occurs. Thus they use the mechanical override to sidestep the original system of gear switch and solenoid.

If that's what they prefer, lift-to-reverse does just that in an even simpler manner, making a one-man job out of it.

With the experience of the years, it is easy to point out the weaknesses in the reverse sense arrangement. These are:

- The normal reversing and emergency cases require different actions by the pilot.
- The solenoid operated latches and the associated mechanisms are subject to both wear and adjustment.

Long ago this led WADC laboratories to conclude that a new objective approach was in order. With the objective stated as "a system of least complication which permits the pilot freedom of action and yet provides notice of reversing," the lift-to-reverse throttles were evolved.

Numerous systems are in use now, including sequence gate, arm and actuate and others, but it looks from here as though many future aircraft designed for the Air Force will incorporate lift-to-reverse propellers as standard equipment.

The surest way to get positive operation is to design it very simply into the equipment, minimizing the mental pain and strain on the human operator. And that, say its backers, is the beauty of lift-to-reverse. ●

★ ★ ★

Reversal in Flight

This article reprinted from the MATS FLYER.

THERE'S a feeling that creeps into the minds of pilots: what would happen if one of those fans suddenly reversed up there at cruising altitude—or even worse, while on the final approach?

Because of a series of tests under the direction of National Airlines the question mark can be erased. We now know what will happen when one propeller is reversed in flight. These tests were conducted on a DC-7 equipped with R-3350 engines and Hamilton Standard Hydromatic constant-speed propellers with full feathering and reverse pitch features.

The tests were conducted because of an incident which happened to a National Airlines flight landing at Tampa, Fla., 18 June 1954.

A DC-7 was rolling out of a left turn on final approach when the flight engineer observed the No. 1 "Reverse" light on bright and steady. The flight engineer immediately called this to the captain's attention and observed that all tachometers were at approximately 2400 rpm. The copilot continued to fly the aircraft down the final.

The captain reduced power on the No. 1 engine, then advanced it to about 35 in. Hg.; RPM responded accordingly between 1800 and 2800 rpm. The copilot stated that it felt like the prop was in reverse and that he had to push right rudder about six inches to correct for yaw during the captain's throttle manipulation.

Crewmembers stated that there was no vibration, buffeting or other unfamiliar sounds.

Just before touchdown the prop was feathered. No. 2 and No. 3 were reversed after landing.

This incident was reported by the crew to their supervisors who, in turn, decided to set up a series of controlled tests to determine just what would happen should reversing occur during flight.

Representatives from Civil Aeronautics Administration, Civil Aeronautics Board, Douglas Aircraft Co. and Hamilton Standard personnel attended a conference wherein National Airlines personnel outlined their prop reverse test procedures.

Special switches were installed. One permitted unfeathering into reverse by pulling out either No. 1 or No. 2 feathering buttons, another permitted the reverse light of No. 1 propeller to come on when the prop was at the approximate 35-degree forward thrust blade angle.

Gross weight at takeoff was approximately 82,980 pounds, and preliminary tests began at 8000 feet involving various rates of descents and airspeeds. During these maneuvers, which simulated final approaches, the No. 1 throttle was moved back and forth duplicating the action taken by the captain on the approach at Tampa.

The reverse light came on at 135 knots indicated airspeed, 110 brake mean effective pressure (BMEP) and $24\frac{1}{2}$ in. Hg., indicating the prop was at approximately a 35-degree forward thrust at 2400 rpm. Speed and power were varied several times to fix this condition. No unusual or abnormal actions were observed, including yaw.

For the reversing test the aircraft was climbed to 10,000 feet with BMEP set at 80 (manifold pressure, 20 in. Hg.), 2500 rpm, gear up, flaps

30 degrees and airspeed 110 knots stable. A 500 fpm rate of descent was established. Next, No. 2 throttle was closed. RPM slowed to 2000. with the propeller windmilling on the low pitch stops. Outside air temperature was +10°C.

The No. 2 feathering button was held out 4-5 seconds with the special switch ON to provide a ground so the prop could reverse. The RPM increased from windmilling at 2000 to approximately 2080 in a matter of one to two seconds.

As the prop reversed, RPM fell off rapidly and throttle advancement was started at about 1500 rpm to keep the engine running in reverse thrust. The No. 2 throttle was advanced to its approximate original position in relation to the other three throttles. Manifold pressure read 23 in. Hg. The RPM slowed to 975 and held.

Rate of descent increased from 500 to 1300 fpm while holding the same airspeed of 110 knots.

Although RPM increased only approximately 80 going through flat pitch into reverse, the flat pitch or reversing sound was easily distinguished. This sound lasted about three seconds, and, as it quit, moderate to severe buffeting commenced, which continued as long as the engine was running with the prop in reverse.

Buffeting was of greater magnitude than that produced by cowl flaps full open on all four engines, but less severe than that associated with a full stall. The buffeting was not of control surface nature. Neither the wheel column or rudder pedals buffeted; instead, it was of a general nature and pronounced throughout the ship.

Those who observed the left wing tip during the test stated that the wing did an oval gyration followed by a yaw movement as the prop went into reverse position.

Propeller reversal tests were made by National Airlines with a Douglas DC-7

The pilot pointed out that the yaw effect was not severe, in fact the ship flew straight with feet off the rudders (no rudder trim) with only slight aileron applied. He believed that more rudder pressure would be required during climb-out at maximum power with No. 2 engine dead and windmilling on the low pitch stop.

When the prop was feathered into forward thrust, the maneuver was discontinued and the aircraft climbed back to 10,000 feet.

Maximum power with No. 2 in reverse thrust was applied this time. But first, the aircraft was set up as before except airspeed was increased to 125 knots with power at 90 BMEP, manifold pressure 21 to 22 in. Hg. on Nos. 1, 3 and 4 engines to maintain 500 fpm rate of descent.

Then No. 2 was reversed in the same manner as before. Initial reverse indications were the same. When maximum power was applied, which resulted in 100 BMEP, 22 in. Hg. and 900 rpm on No. 2, power on 1, 3 and 4 was increased to maintain the 500 fpm rate of descent. Buffeting, wingtip gyration and control pressure were the same as in the previous maneuver.

After unreversing and climb to 10,000 feet were accomplished, the No. 2 propeller was reversed for the third time, but with airspeed indicating 140 knots. The engine stalled on the first attempt (throttle was not advanced quickly after reversal) and rotated approximately one revolution backwards.

No. 2 was feathered out of reverse, and at 140, windmilling 2400 rpm against the low pitch stops, it was again reversed. The surge while going into reverse was approximately 2500.

At 7000 feet, 100 BMEP and 24 in. Hg. turned No. 2 at 840 rpm. Nos. 1, 3 and 4 engines were set at 192 BMEP and 2500 rpm to maintain 140 knots.

Full throttle on No. 2 produced 127 BMEP, 27 in. Hg. and 1100 rpm and 650 fpm rate of descent. At 6000 feet the flaps were fully retracted and level flight maintained at 150 knots indicated. And No. 2 engine RPM slowed to 980.

No. 2 was then throttled back to 70 BMEP, 24 in. Hg., where it turned 500 rpm. The aircraft then climbed 300 fpm, still indicating 150 knots with power on engines 1, 3 and 4 still at 192 BMEP and 2500 rpm.

Similar tests were conducted on No. 1 engine. Slightly higher power settings were used on No. 2, 3 and 4 engines to maintain 165 knots than those used with No. 2 propeller in reverse. Power setting on No. 1 engine while in reverse was 760 rpm, 110 BMEP, with manifold pressure 23.5 in. Hg.

As the propeller reversed, the left wingtip again did an oval gyration followed by the yaw movement. This oval gyration was considerably more pronounced than it had been when the No. 2 propeller was reversed.

On this reversal, as in the others, the sound during reversing and buffeting while in reverse was approximately of the same magnitude.

As was anticipated, No. 1 engine in reverse produced more yaw than No. 2. However, the aircraft at this speed was not difficult to control. The test pilot estimated that less rudder pressure was used here than would be used on a maximum power climb out with No. 1 engine dead and windmilling on the low pitch stop.

These tests provided a wealth of information about this heretofore "unknown." In summary it was concluded that:

- An in-flight reversal produces a definite "reversing" sound, even with little or no power on the engine (throttle closed).
- While the aircraft is operating with a prop in reverse, moderate to severe buffeting will be encountered.
- The engine will stall and windmill backwards in a matter of seconds after the prop reverses if considerable throttle is not quickly applied.
- The RPM on the reversed engine and prop will be very low even at full throttle, and will decrease inversely proportional to airspeed.
- To unreverse, the throttle should be closed and the feathering button pushed. After the prop goes from reverse to forward thrust, pull the feathering button to neutral and advance the throttle.
- Yaw effect of a propeller in full reverse at full throttle appears to be moderate with the aircraft definitely directionally controllable.

It was further concluded that the incident at Tampa described in the beginning of this article, was not caused by propeller reversal because no reversing sound was heard by the crew, the propeller in doubt continued to operate in normal RPM range, the engine continued to run normally and no buffeting was encountered. ●

WELL DONE

1st Lt. Lloyd J. Kelly

332d Fighter-Interceptor Sq.
New Castle County Airport, Del.

SHORTLY after 1st Lt. Lloyd J. Kelly took off on a day navigational flight from Selfridge AFB, Michigan, the engine of his F-94C surged and then the RPM fell off to 12 per cent. At the time the power loss occurred, Kelly's aircraft was over the center of Detroit, Michigan, at 3500 feet. He immediately initiated a 180-degree turn back toward Selfridge, but after rolling into the turn, realized that he could not make it to the base.

He then saw Detroit City Airport and set up a downwind leg for the longest runway (4600 feet). Selfridge relayed a message to the Detroit tower to the effect that Kelly was making an emergency landing at that airport. As he turned on base, the engine flamed out completely.

Lt. Kelly was unwilling to jettison the two practically full 250-gallon tiptanks because of the heavily populated area below him. Kelly had many obstructions in the traffic pattern that he had to maneuver his aircraft to avoid, including several tall smoke stacks, a butane storage tank 315 feet high and numerous small planes in the immediate area around the field. His final approach was made over houses and high tension wires that extended right up to the end of the runway.

Touchdown was made in the first 1000 feet of the runway and the drag chute deployed at once. Although the right main tire blew, causing the aircraft to veer off the side of the runway into the mud, Kelly brought it to a successful stop with only slight damage. Neither crew member was injured, and there was no damage to any privately owned property.

Through his quick thinking, excellent judgment and superior flying technique, Kelly turned what could have been a tragic accident into an incident that reflected much credit to himself and to the U. S. Air Force.

The city of Detroit voted Lt. Kelly a letter of commendation and thanks for his actions. If Lt. Kelly had bailed out or jettisoned his tiptanks over the heavily populated area, property damage and probable loss of life would have resulted. Well Done!

ANYMOUSE

and his hairy tales

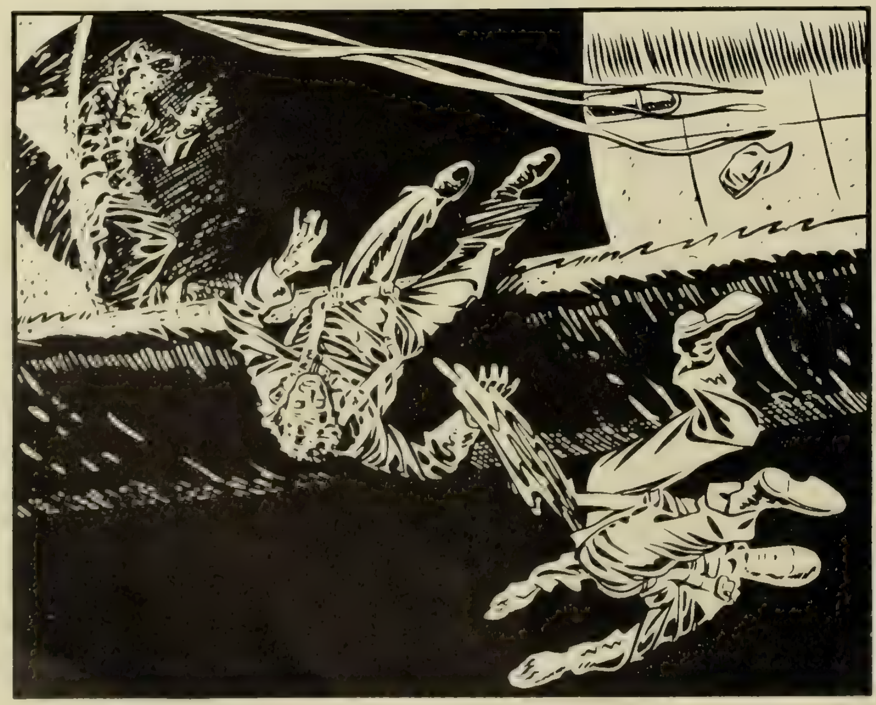
EVERY now and then one of us is called upon to perform some duty with which he is not too familiar, just like the crew in the following story. Their particular mission, though not routine, could hardly be considered hazardous. They were assigned the duty of performing a parachute drop of dummy figures during "open house" on Armed Forces Day.

A competent, experienced NCO from the parachute department was given the responsibility of preparing for the flight. The actual crew performing the drop consisted of a pilot, copilot, dropmaster, assistant dropmaster and three airmen from flight operations. The dropmaster and his assistant were briefed on ejecting the dummies. One of the operations airmen was to withdraw the arming cable for the automatic release of parachutes immediately prior to throwing out the dummies.

The C-47 assigned to the flight was equipped with electronic equipment that left little space between the para-door and the aft portion of the equipment. Following takeoff, the dropmaster placed himself just forward of the para-door and aft of the electronic equipment. The assistant was just aft of the para-door and was tied in by means of a safety strap. An operations airman manned the inter-com which is installed on the aft wall of the cabin. After the operations man had difficulty hearing the instructions relayed from the pilot's compartment, he and the dropmaster exchanged positions.

The first dummy was dropped, then, while reaching for the second one, the operations airman inadvertently pulled the emergency release on the cargo door. The door flew open, out flew the second dummy and along with it . . . the operations man. Fortunately, he cleared the aircraft and made a successful parachute descent and landed without injury.

"The cargo door flew open, out flew the second dummy and along with it—the operations man."



— — —

It is well within the realm of possibility that you too may someday have to perform some duty that is not covered by SOPs, regs and the like. If such should happen, and you are certain there are no printed guides available, attempt to find someone who may have some experience even if that experience was gained from only one mission. Make some practice dry runs to work out all the bugs and prevent possible mishaps. There is more than one way to skin a cat. Don't leave anything to chance.

★ ★ ★

THE weather was reported to be 300 feet with 1/3 mile visibility in light rain as I started my GCA approach. Upon reaching minimums (200 feet and ½ mile), I still could not see the runway, but I did see what appeared to be scud clouds, slightly ahead and below. I was tempted to descend a little more, when suddenly I realized that the "scud clouds" were actually white-caps of the waves washing up on the beach at the end of the runway. You can imagine what would have happened had I tried to get under the "scud."

— — —

GCA minimums mean just that . . . This is as low as you can descend until the runway is definitely sighted.

This pilot's experience may well tie in with the slant range visibility problem. (See "Slant Range Angles" in the August 1954 issue of FLYING SAFETY.)

This anymouse also brings up something on procedures. Experienced crews, when performing a GCA run, always rely on the copilot to watch outside for visual contact, while *the pilot concentrates on the instruments. Once the aircraft is definitely in the clear, the transition is made from the gages to VFR flight.*

As our records indicate, attempting to fly contact under IFR or marginal weather conditions sets the stage for inadvertent descent below minimums. It's human to crowd your luck when you can almost see the ground.

★ ★ ★

FOR a number of years I have read articles in FLYING SAFETY and similar publications concerning thunderstorms in general and in detail, and the effects of lightning upon aircraft. I have never read of anyone being killed or injured by lightning while in inclosed cockpit type aircraft.

To the best of my knowledge, training schools still teach the theory that aircrew personnel cannot be injured by lightning (other than by momentary "flash" blinding), provided they are in inclosed cockpit type aircraft. The following personal experience therefore may be a rarity and of some value in future subjects your publication might run on the effects of lightning strikes.

On 2 September 1950 I was returning from a mission over North Korea in an RB-17 type aircraft, en route to my station at Johnson AFB, Japan. About 150 miles from landfall, over the Sea of Japan, just as I broke out of a moderate thunderstorm, my aircraft was hit by a bolt of lightning. The bolt entered the aircraft via the trailing antenna, bounced off the antenna reel in the waist section, ricocheted off a thermos jug, passed through the body of one of my waist gunners and followed the fuselage back to the tail section where it departed the aircraft, burning buckshot-size holes in the skin.

All radios except the VHF set were rendered inoperative, and the navigator informed me that he thought the magnetic compass was magnetized to a point where it was giving a false reading of 60 degrees or more. This fact was never definitely confirmed.

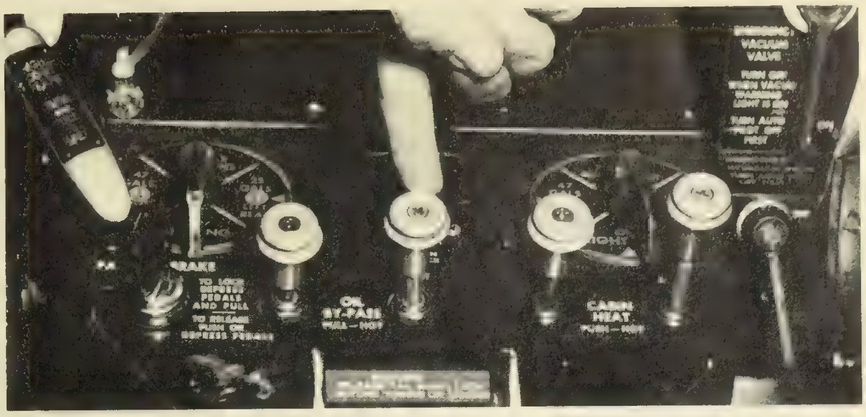
I immediately turned the controls over to my copilot, and checked on the gunner's condition. He was in a state of shock, unconscious and was burned around the eyes. At least one and possibly both of his arms were badly burned. We treated him for shock and put ointment on his various burns. Although we were not sure of it until he had received medical care on the ground, he was temporarily blinded but regained his eyesight some few days later.

To the best of my knowledge, no formal report was rendered on this incident because damage was confined to wiring and a relatively small amount of sheetmetal work.

— — —

This incident certainly does fall into the bizarre category. In general, the incident followed standard lightning strike patterns for cargo aircraft. It hit an antenna, bounced around the interior of the plane and went out the tail-cone. What makes this one different is that a crewmember was injured. In 1953 a total of 25 lightning strikes were reported, none of which resulted in an injury.

The lightning hit the antenna, bounced around the interior of the plane, went out the tail-cone.


VACUUM VALVE
BRAKE
TO LOCK DEPRESS PEDALS AND PULL
TO RELEASE PUSH OR DEPRESS PEDALS
OIL BY-PASS
CABIN HEAT

He found his mistake; he had pulled the right oil by-pass button instead of the left cockpit heat.

I WAS returning to my home base in a C-45G after a three-hour night VFR flight and started a letdown from 7000 feet, about 30 miles out. The cockpit became warm as I descended, so I reached over and pulled what I thought to be the left cockpit heat knob. About a minute later, the oil temperature on the right engine hit the peg; I took off the power and the copilot and I started looking for the trouble. We found it easily enough. I had pulled the right oil by-pass button instead of the left cockpit heat. Recommendations hardly seem necessary at this point.

— — —

Like the man says, recommendations hardly seem necessary. The old saying, "Look before you leap" certainly applies here.

Check your altitude before you . . . Shift to HIGH

THE C-82 took off and made two climbing 360's, reaching for altitude. At 5000 feet the pilot started off on course, still climbing. The aircraft cleared the first ridge of mountains by some 1000 feet, but higher terrain lay ahead and the climb was continued. The power settings were 42 in. Hg. and 2500 rpm when, at 7000 feet, the No. 2 engine started to backfire. The fuel flow on the No. 2 engine dropped to idle, and it became apparent that the aircraft would not climb fast enough to clear the oncoming 8000-foot mountain range. More power was needed on No. 1 engine, and the pilot quickly moved the supercharger controls to the high ratio position. With the engagement of the blower there was an immediate increase in manifold pressure, but what's this? The engine seemed to produce less power. Number 2 engine was stone cold dead, and No. 1 wasn't cutting the mustard. The pilot had to give the bailout order.

The above story is true, and it cost the Air Force an aircraft. Although there were other contributing factors to the accident, the cause of the power loss on No. 1 engine is the important one. It may bring out some forgotten facts concerning the correct operation of superchargers.

The C-82, like the B-26, C-46 and other aircraft, is equipped with single-stage, two-speed superchargers. This type of supercharger has a larger, more complex system than the single-stage, single-speed type. It incorporates a gear shifting mechanism by which the single impeller may be driven at one of two different ratios to crankshaft speed: Low or High.

At or near sea level the engine is operated in the low impeller gear ratio, thus keeping to a minimum the temperature rise through the supercharger and the power lost in rotating the impeller. At a specified altitude determined by the engine type and the operating conditions, the shift is made from the low to the high gear ratio. The increased airflow and higher manifold pressures available in the high ratio make possible continued high performance to still greater altitudes.

Maximum performance during climb will be assured only when the shift from low to high ratio is made at the proper altitude, as determined in the Operating Instructions. If the need for high performance at any given altitude is not required, the use of the low impeller may be continued if sufficient power is still obtainable.

If the shift from low to high ratio is made below the proper altitude, the *result is a loss of available power*, even though the manifold pressure increases. Using this high position below the designated altitude will reduce the brake horsepower available to the propeller at any given RPM or manifold pressure because of the power absorbed by the impeller as its speed is increased. (See Figure 1.) A further objection lies in the greater temperature rise imparted to the fuel charge by the impeller in the high gear ratio. At low RPM this may not prove serious, but at high RPM it may lead to detonation.

When the proper shift altitude has been reached, the shift from low to high ratio is made as follows:

- Reduce the manifold pressure three or four in. Hg. (Do not change RPM setting.)
- Move the supercharger from LOW to HIGH without hesitation.
- Adjust the throttles to the desired manifold pressure setting.

The partial closing of the throttle that immediately precedes the actual shift is made to prevent excessive manifold pressure rise after the impeller has been engaged in the high gear ratio. A few trials should familiarize the pilot with the necessary throttle movement.

As you have probably surmised, the pilot of the C-82 experienced loss of power on No. 1 engine because he shifted to high blower about 5000 feet below the recommended altitude of 12,300 feet. This early shift from low ratio to high ratio operation resulted in a loss of nearly 200 thrust horse power to the propeller.

If the aircraft you fly is equipped with the single-stage, two-speed supercharger, familiarize yourself with its limitations as well as its advantages. Individual Pilots Operating Instructions should be your guide on checking and operating the supercharger on your airplane. However, there are a few general fundamentals that apply.

All ground operations of the engine, such as starting, warm-up, idling and taxiing should be performed with the supercharger in the low impeller gear ratio.

During preflight, when the oil temperature rises to at least 40°C., set the propellers at high RPM and open the throttles to 1700-1800 rpm. Move

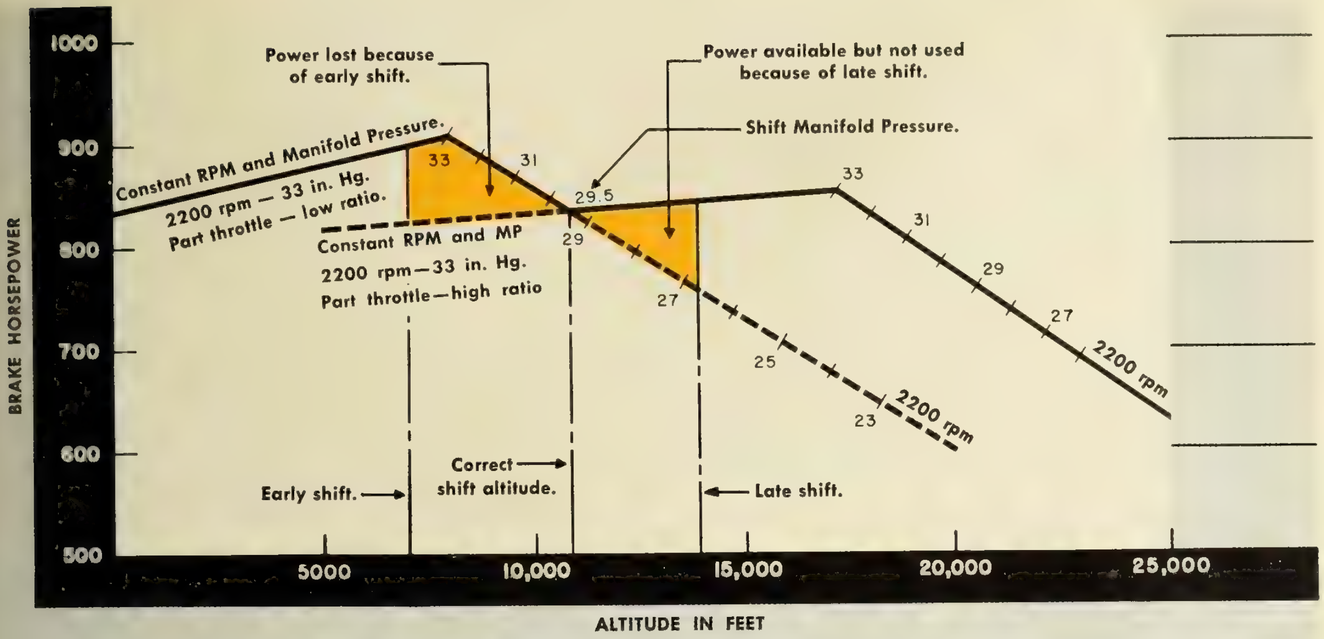


Figure 1. Results of shifting too early or too late during the climb.

the supercharger from LOW to HIGH. A slight drop in oil pressure and increases in manifold pressure and RPM will indicate that the selector valve is supplying oil to both clutches and that they are engaging properly. Open the throttle to 2000 rpm and return the control to LOW. Note a momentary drop in oil pressure and a decrease in manifold pressure and RPM.

Should erratic changes in oil pressures, manifold pressures or RPM occur, indicating improper operation, repeat the cycle after first idling the engine at 1000 rpm for two minutes to permit the clutches to cool. In making any shift, the control level must be moved quickly and without hesitation between positions.

Takeoffs, under all conditions, regardless of altitude, should be made in the low impeller ratio. The use of the high impeller at or near sea level will reduce the horsepower available to the propeller as well as increase the tendency of the vaporized fuel charge to detonate. Since the impeller lies between the carburetor and the intake pipes, no preheating is accomplished by using the high ratio, and the possibility of carburetor ice is not lessened thereby.

The impeller ratio for cruising is selected with reference to altitude and type of operation (percentage of horsepower) desired at that altitude. For maximum fuel economy it is generally desirable to operate in the low ratio whenever possible. However, there is actually little difference in cruising performance between full throttle operation in the low ratio at high RPM and full throttle operation in the high ratio at low RPM, provided the brake horsepower is the same in both instances. In general, after reaching the proper altitude, a half closed throttle in the high ratio indicates the desirability of shifting to the low ratio position.

On extended flights, clutch shifts should initially be made every two hours. At each of these times two or more complete shift cycles (i.e., LOW to HIGH or vice versa and return) should be made, and the clutch into which the shift has been made should be allowed to operate for about two minutes. This time interval is required between shifts to allow the heat to dissipate. If the exercising shifts are made during operation in the low ratio and RPM and manifold pressure and carburetor air temperature are sufficiently low, it will be unnecessary to climb to the shift altitude, because the operation in HIGH is of such limited duration.

The clutch shift is not necessary on short flights because the preflight clutch check performed prior to takeoff will serve to keep the clutches free of sludge accumulation.

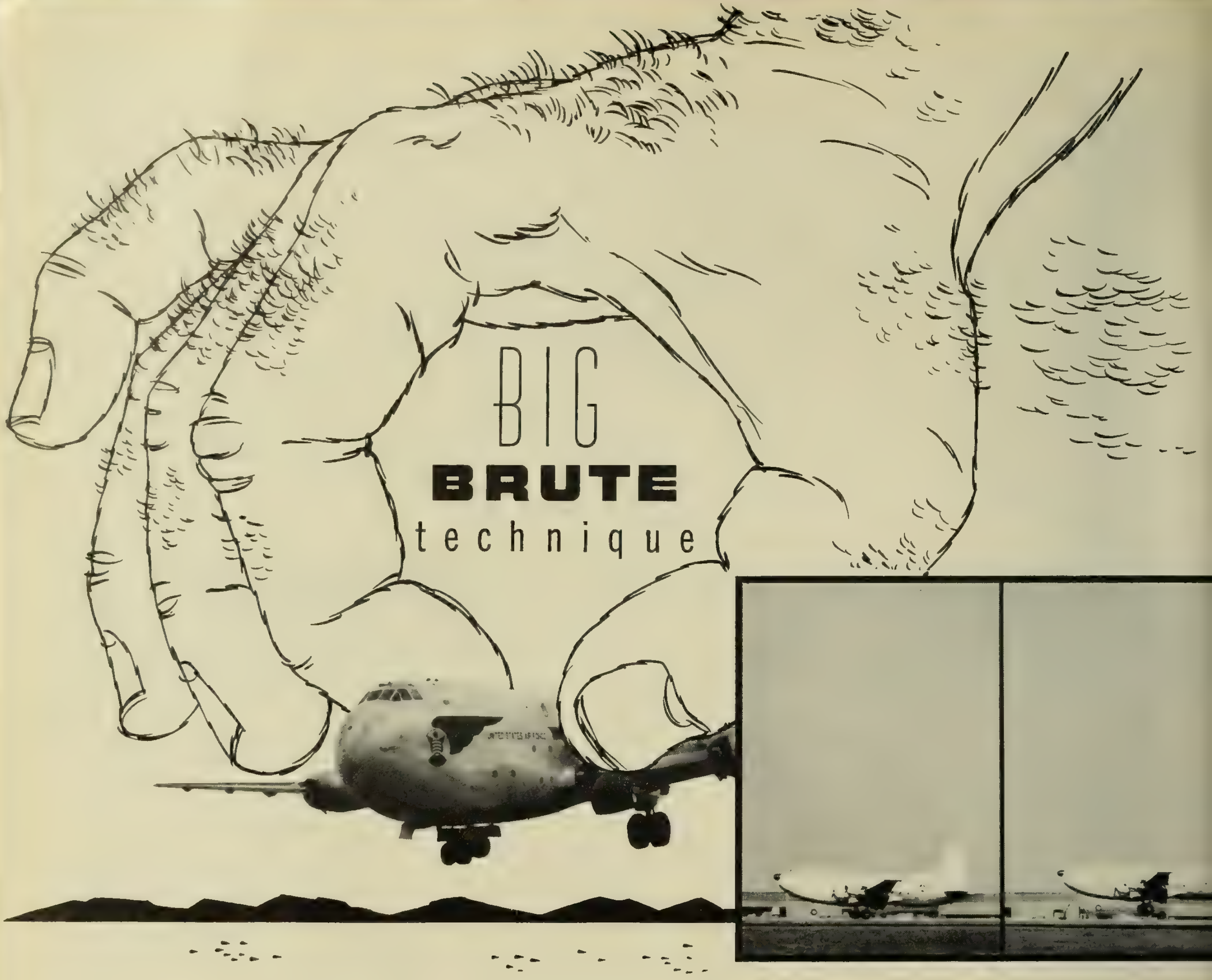
During a gradual cruising descent or when making a normal letdown from altitudes at which it has been necessary to use the high impeller ratio, the supercharger should be shifted to LOW as soon as practicable and regardless of altitude, unless, of course, you plan to level off above the proper shift altitude. However, if the need for maximum performance may be required during the descent, the shift from HIGH to LOW should not be made until the shift altitude has been reached.

Glide and approach for landing should be made with the controls in the LOW position. In the event of an emergency, the pilot will then have maximum power available.

Because the heat rise imparted to the fuel charge by the supercharger is normally greater in the high impeller ratio, the carburetor air temperature limits are lower. Care must be taken to observe these limits, otherwise detonation may result. Flight operations should be performed in the low impeller ratio, regardless of altitude, whenever the carburetor air temperatures are above 16°C.

The supercharger is an invaluable piece of equipment when properly utilized. Don't make it a detriment through improper operation. ●

BIG BRUTE technique



Here is a story prepared by Douglas Aircraft Co. test pilots on C-124 handling techniques in the traffic pattern.

ALTHOUGH parts of the following discussion may appear elementary, it is an established fact that we sometimes overlook elementary factors and as a result, come to a cropper.

Let's start then by a general review of handling characteristics and the factors that affect them. The elevator control forces and movements required vary throughout the speed range of the airplane. At high speed, the elevator is extremely effective and therefore requires a very small amount of movement to control the plane during normal maneuvers. At low airspeeds, such as during the landing approach, elevator effectiveness decreases, requiring a greater movement to obtain response.

During landing the center of gravity greatly affects the amount of elevator required. The further aft the CG the less elevator required. Moving the CG forward increases this control requirement. As in any airplane, loading aft of the CG limit will cause an unstable condition and if loaded ahead of the forward limit, the amount of elevator control available will probably be insufficient to flare the airplane.

Elevator requirements vary also with power. For example, as power is applied during an overshoot, forward stick is required to counteract for nose-up pitching; and conversely, as power is cut during the landing flare, back pressure is required.

The wing flaps provide the additional lift required for takeoff, and produce both extra lift and drag for approach and landing. At small angles (20° to 25°), the flaps act primarily as an added lift device, and at large angles (40° to 45°), as both an added lift and drag device. High drag resulting from maximum flap extension, is obtained primarily from the amount of extra surface exposed to the airstream.

In effect, as the flaps are extended, the camber of the wing is increased. This produces more lift at any given angle of attack and reduces the airplane's stalling speed. The changes resulting from flap extension are included in Figure 1.

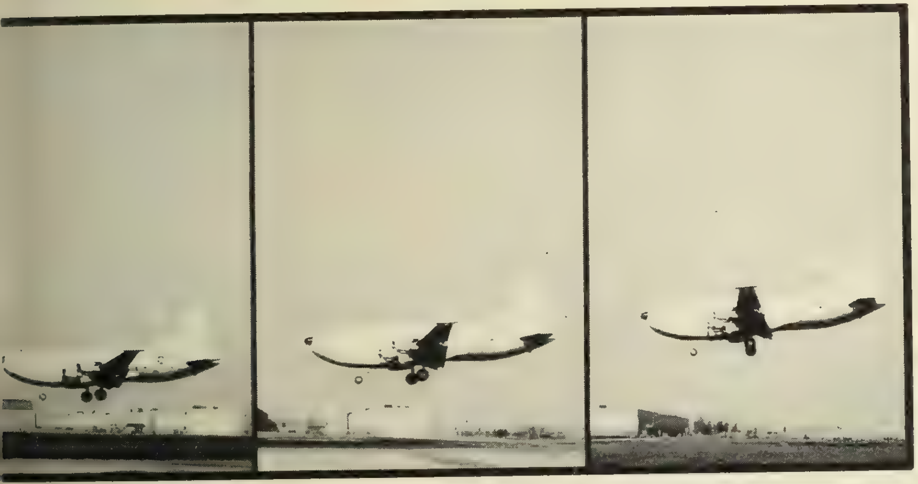
At a given speed, the flight path can remain constant during flap extension or retraction if the attitude and power of the aircraft are properly controlled.

Final approach and landing per-

FIG. 1

Flap Position	**Lift Increase** % C_L Max.	**Stall Speed @ 160,000 lbs.**
0°	0%	108 knots
10°	12%	103 knots
20°	24%	98 knots
30°	35%	95 knots
40°	44%	92 knots
45°	48%	90 knots

With the airplane in proper attitude for touchdown, at 110 per cent of stalling speed with flaps full down, a problem to a pilot is that his eye level is approximately 34 feet above ground.



formance, as well as takeoff and initial climb performance, should be determined by reference to the appendix of the Flight Handbook (Pilot's Operating Instructions).

In order to remain consistent with the methods used in determining glide and landing performance, the Douglas Aircraft Company has recommended speeds for the various configurations used during approach and landing on the following basis:

- *Initial approach* with gear up and 10 degrees flaps — 140 per cent of the stalling speed.
- *Downwind and base legs* with gear down and 20 or 30 degrees flaps — 140 per cent of the stalling speed.
- *Landing approach* with gear down and full flaps — 130 per cent of the stalling speed.
- *Landing flare* (across the fence) with gear down and full flaps — 120 per cent of the stalling speed.
- *Touchdown* with gear down and full flaps — 110 per cent of the stalling speed.

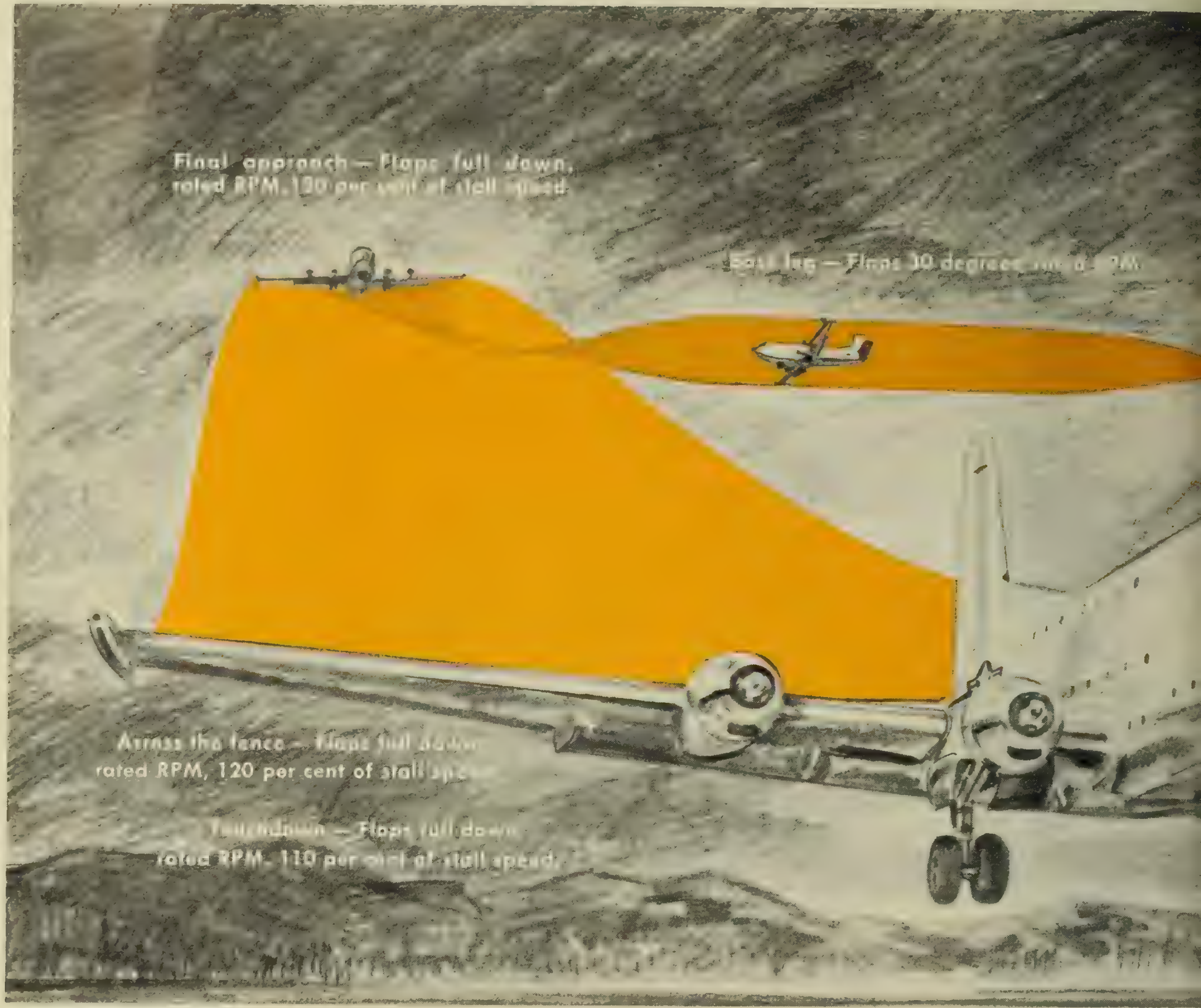
Power-off stalling speeds for the specific gross weight and flap configurations are used as the basis for these recommendations. These speeds are high enough to provide the necessary margin above stall to withstand turbulence, and also to provide adequate maneuverability throughout the approach pattern.

- *Initial Approach:* Use the recommended initial approach configuration and speed for either four or three engine operation. Note that all of the speeds quoted provide almost maximum performance during a missed approach for the "one engine out" condition. If a missed approach should occur, first establish climb at the same airspeed used during the approach, then make the transition to the recommended climb configuration and speed.
- *Downwind and Base Leg:* In making the transition from the initial approach to the downwind and base leg configuration, maintain constant power and altitude. As the gear and flaps are extended on the downwind leg, allow the airplane to decelerate to the downwind approach speed. With this technique, practically no change in power settings or trim will be required.

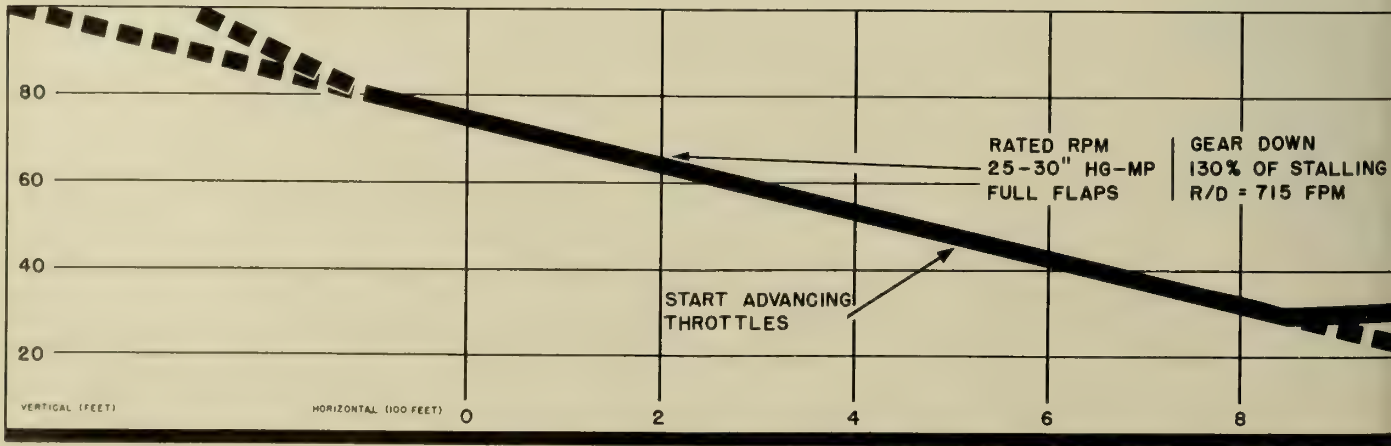
Proper speed-power control is one of the most important factors in executing a good approach. Therefore, it is felt that the pilot should control the throttles. The man flying the airplane is the one who most readily recognizes the power requirements and can make necessary power adjustments with minimum delay. The time interval between verbal orders and ultimate execution, along with the possibility of misunderstanding, are obvious hazards of indirect power control by interphone instructions.

The pilot who does not have complete control of the power might wind up like the hapless soul who recently dropped a Globemaster in much too hard. In this case the driver saw that a go-around was fast becoming a necessity and called for "takeoff power!" The engineer did exactly as instructed. . . . He took off all the power.

- *Final Approach:* Upon turning onto final, a glidepath of from three to five degrees provides a comfortable approach slope. It can be approximated by planning the approach so as to arrive at about 500 feet above the runway level when approximately one mile from touchdown. Power required will vary with wind, gross weight and flap setting, but should normally be between 25-30 in. Hg. of manifold pressure and rated RPM. When not more than one mile out, set up the landing approach configuration and speed for four or three engine operation. Control the rate of descent by variation in power rather than variation in airspeed. It is recommended that full flaps normally be used for the last half mile of the final approach. Flap setting should not be changed close to the point of touchdown.
- *Landing:* With a properly planned approach, a slight amount of power should be maintained until the landing flare is completed. If the throttles are closed prior to the flare, more elevator deflection is required to increase the angle of attack. An increase in angle of attack is neces-

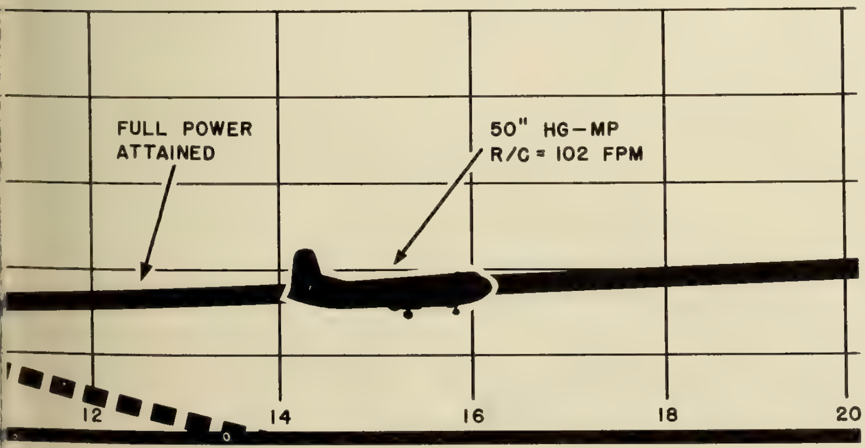

Final approach — Flaps full down, rated RPM, 120 per cent of stall speed.
Base leg — Flaps 30 degrees, rated RPM.
Across the fence — Flaps full down, rated RPM, 120 per cent of stall speed.
Touchdown — Flaps full down, rated RPM, 110 per cent of stall speed.

Above, a typical C-124 landing pattern.



wind leg — Flaps 20 degrees, rated RPM, gear
140 knots, pre-landing checklist completed.

Below, graph illustrates the approach and go-around flight paths.



sary in order to reduce the airspeed and to secure enough lift to change the glidepath of the airplane. Also, as the power is reduced, the propeller governors attempt to maintain the selected RPM. A windmilling propeller increases the total drag of the airplane and decreases the airflow over the wing and, consequently decreases the wing lift.

The angle of attack of the wing increases on the flare-out and varies with the steepness of the approach and the airspeed. A high airspeed on the final approach, coupled with a steep glidepath, requires a greater change in attitude, therefore more elevator deflection is necessary. As the rate of descent increases, the altitude consumed in completing the flare also increases. This rapid change in angle of attack will also cause a more rapid decrease in airspeed.

One of the more predominant problems facing any pilot of large, multiengine aircraft is his position in relation to the ground. This is especially true in the C-124.

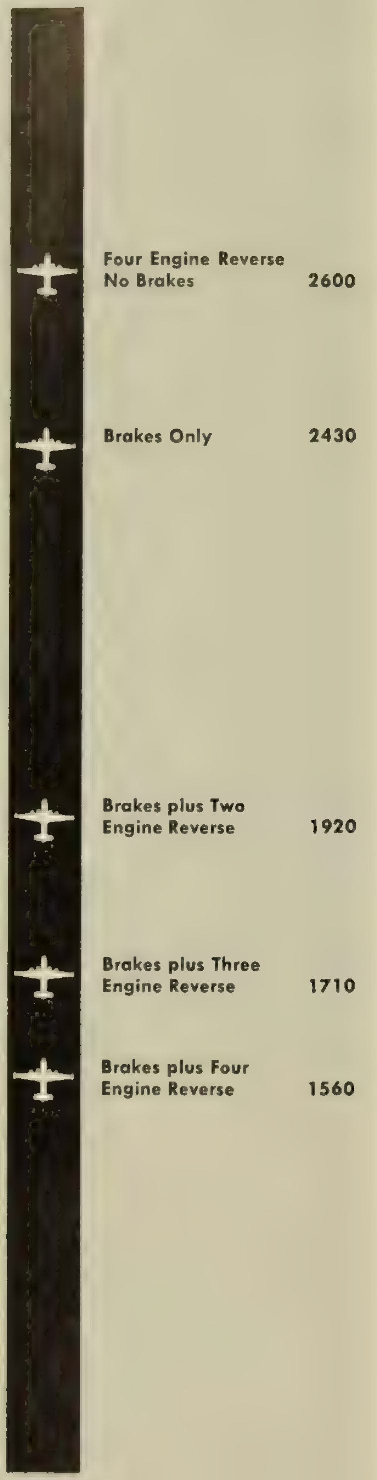
On the ground, in a three-point position, the normal eye level is approximately 24 feet above the ground. With the airplane in the proper nose-high attitude for touchdown, at 110 per cent of stalling speed with flaps full down, the eye level distance increases to 34 feet. Until one gets used to it, this attitude presents a bit of a problem.

The recommended speed for across the fence (120 per cent of the stalling speed in that configuration) provides adequate airspeed margin to properly flare the airplane, provided the glide angle is not too steep.

As the landing flare is completed, gradually reduce power and continue increasing the angle of attack to land the airplane on the main wheels with the nose held up. After touchdown gently but firmly lower the nose wheel onto the runway. Maintain directional control primarily through the use of nose wheel steering, because as soon as props are reversed the rudder is automatically snubbed.

For maximum effectiveness, apply reverse thrust as early in the landing roll as possible, because thrust decreases in effectiveness at the lower rolling speeds.

- *Engine Out Operation:* Although the approach and landing configurations and speeds are generally the same for three or four engine operation, there are a few exceptions that should be kept in mind. On three



C-124 Table of stopping distances in feet. Based on a standard day, weight at touchdown 160,000 lbs.

engine operation, do not lower flaps more than 30 degrees until the landing is positively assured. With this flap setting less time is consumed transitioning to the recommended climb configuration and speed in the event of a missed approach or go-around.

For two engine approaches, remain in the clean configuration until the base leg is established. The landing gear should not be extended or flaps lowered more than 20 degrees until definitely committed to land. As power is reduced on final approach, remove excessive trim, make a normal round-out and touchdown. After landing, if reverse thrust is used, follow the recommended reverse thrust procedures.

Missed Approaches

- *Four Engine Operation:* If obstacle clearance is required during a four-engine overshoot, simultaneously apply maximum power, establish initial climb-out speed (110 per cent of stalling speed), retract the flaps to 20 degrees, retract the gear, and then proceed as during a normal takeoff.

If obstacle clearance is not required, the transition should be made directly to the climb configuration and best climb speed, as recommended by the Flight Handbook, using power as necessary for required rate of climb.

- *Three Engine Operation:* If a three-engine overshoot becomes a reality from a speed below the final approach airspeed, apply maximum power, accelerate to initial climb-out speed (100 per cent of stalling speed), then retract the flaps to the 20-degree position and retract the landing gear. Begin climb when initial climb-out speed is reached. Maintain initial climb-out speed until obstacles are cleared, then make the transition to the best climb configuration and speed.

Be alert to meet control requirements resulting from application of maximum power at low airspeed.

If a three-engine overshoot occurs from the final approach airspeed, simultaneously apply maximum power, maintain existing airspeed, retract the flaps to the 20-degree position and retract the gear. Climb as required for obstacle clearance at initial climb-out speed (110 per cent of stalling speed). As soon as obstacles are cleared, make the transition to the best climb configuration and speed.

For most effective deceleration after landing, use maximum braking possible and maximum reverse thrust on the remaining engines within the limits of directional control. Banking and turning tendencies encountered in reverse thrust may be controlled by the use of nose wheel steering and by the amount of symmetrical or asymmetrical reverse thrust applied.

During an aborted takeoff or a three-engine landing, before using reverse thrust, first obtain positive directional and lateral control of the airplane. Next, apply symmetrical reverse thrust, by simultaneously reversing opposite inboard or outboard engines. The third engine may be reversed as soon as speed has decreased below normal landing speed. As soon as corrective control action has been taken to compensate for a symmetrical reverse thrust, power on the remaining engine may be increased to the limits of directional control.

During a two-engine landing with two engines on the same side inoperative, before using reverse thrust, first obtain positive directional and lateral control of the airplane. Next, below normal landing speed, reverse the inboard engine, then after corrective control action has been taken, reverse the remaining engine. Increase power in reverse thrust slowly to prevent exceeding the limits of directional control.

A cross-wind will materially affect the amount of corrective control action required to compensate for bank and yaw tendencies during either symmetrical or asymmetrical reversing. In a cross-wind, apply symmetrical reverse thrust; as experience indicates that the pilot can maintain directional control by use of the nose wheel steering and by the amount of reverse power applied.

To obtain maximum braking, first apply reverse thrust (this increases weight on the wheels), then apply brakes by first partly depressing the brake pedals, then gradually increasing braking pressures up to the maximum possible without sliding tires.

In summary, it can be said that the Globemaster is a lot of airplane and should command your respect. But, it has good, dependable flying characteristics and the requirements for keeping out of trouble here are the same as when flying any other good airplane. . . . *Follow the Approved Procedures!* ●

Well Done

Lt. Colonel Charles W. Boedeker

3600th Flying Training Wing Luke AFB, Arizona

LT. COL. Charles W. Boedeker was participating in a practice air to ground gunnery mission in an F-84G aircraft. He had started his turn and dive toward the target from an altitude of 7500 feet when he became aware of complete loss of elevator control.

Colonel Boedeker immediately applied full rudder and throttle and was able to bring the aircraft back to a straight and level flight attitude. Further testing revealed that forward and aft movement of the control stick had no effect on the attitude of the aircraft, however, by using the throttle and elevator trim tab control he was able to maintain a fairly constant altitude.

Keeping in mind that excessive use of the trim tab could result in burning out the electrical motor, Colonel Boedeker made the decision to attempt a landing using the throttle as an elevator substitute and the gunsight pipper as reference on the horizon.

With the instantaneous reaction of the pipper in regards to the aircraft's attitude he was able to note any deviation from level flight and counter with throttle.

Upon sighting the field, Colonel Boedeker lowered the landing gear and flaps. After the preflight check was accomplished, he lowered the nose of the aircraft until the gunsight pipper was superimposed over the end of the runway. By maintaining a constant airspeed and keeping the pipper on the end of the runway, he was able to effect an even rate of descent.

Over the runway, he cut the power, allowed the aircraft to settle to the ground and completed the landing.

Investigation revealed that a bolt had slipped out of the proper position and allowed the elevator control rod assembly to become disengaged from the elevator control bob weight.

The forethought, planning and superior skill displayed by Colonel Boedeker averted an almost inevitable major aircraft accident. Well Done!

Smoking FACTS

In order to select capable pilots, the Air Force performs one of the most careful and exhaustive physical examinations which can be given. As a result, the men who are chosen to fly are not only among the most healthy, but also among the most physically perfect human beings.

There is a great deal of importance in such careful selection. Today's pilots travel faster, travel farther and travel higher than any other living men, and for that matter, any men who have ever lived. And the accomplishments of tomorrow's pilots will be even greater.

In these remarkable conquests of time and space, man is pitting his physique and his senses against conditions that are new and demanding, and under circumstances where there is no tolerance for the unfit.

Consider the role of vision. A pilot who is traveling at 550 knots covers a mile in a little more than six seconds. Anything before him must be clearly and exactly detected while it is far away. A mile or more of vital space could be lost in the time it takes to give a second look.

And the need for clear vision is not confined to jet aircraft alone. At any speed in any aircraft a pilot must clearly see all adjuncts to flying, including cockpit instruments. He must readily perceive all objects of warning, such as navigation lights. And he must immediately recognize all threats to landing, whether it is a short runway or another aircraft in the traffic pattern. The clarity of thought which man uses in the guidance of his aircraft is based upon the clarity of his perception.

Not only vision, but all of man's senses, his hearing, his balance and even his sense of touch, must function with a high degree of perfection in aerial flight. And there must be a high degree of perfection in his physique. Consider the need for oxygen. From time immemorial man has been bathed in the heavy, dense air of the earth's surface where the oxygen he required was readily available. However, in the high, thin air, this vital element is so scarce that life can not be sustained. And even when oxygen is carried aloft and breathed 100 per cent pure, it loses its effectiveness when the atmospheric pressure drops low because it can not be pushed into the blood in the quantities to which man is accustomed. Under such circumstances, a pilot's stamina and his ability to react suffer from undernourishment. No substandard physique can meet these challenges.

Most pilots recognize the things which interfere with their health and avoid them. However, there are some things which a pilot may do inadvertently or through ignorance that seriously interfere with the proper functioning of his senses, his body, or his mind. Among these are attempting to fly when ill, when taking drugs or when slowed down by the aftermath of alcoholic indiscretion.

Also in the category of factors which may compromise the pilot's ability, are the effects of smoking. These effects are probably more deleterious than is commonly realized. The article by Dr. McFarland on this subject is something to which every pilot should give thought.

This article, written by Dr. Ross A. McFarland, is reprinted from Aviation Week Magazine.

SCARCELY anyone has missed the recent publicity given to the possible connection between heavy smoking and cancer of the lungs. Most of us have also been exposed to statistics which say that non-smokers tend to live longer than heavy smokers, or that heavy smokers more often develop heart disease.

Whether smoking is the culprit or not, the problems involved are long range ones, important for the longevity of all people in all walks of life. It is less well known that the immediate effects of smoking can be problems to those who fly in aircraft, immediate problems in terms of efficiency and safety.

Tobacco Smoke—Nicotine and carbon monoxide are the substances of chief concern in the smoke which enters the mouth and respiratory passages. Various irritants are also present which are responsible for the local effects of smoke on the eyes and mucous membranes. Tobacco tars may possibly influence the formation of cancer, but the evidence for this is not clear. The presence of lead and arsenic resulting from insecticides used on the tobacco plant is of unproved importance.

Nicotine—The tobacco in the average American cigarette is about two per cent nicotine. So-called "dinicotinized" brands containing about one per cent have thus eliminated only one-half of that originally present. When tobacco is burned, only a part of the nicotine is destroyed.

Much of it is volatilized into the smoke. If the smoke is inhaled, almost all of its nicotine is absorbed; if the smoke is not inhaled, about two-thirds of the nicotine present is absorbed through the mucous membrane lining the mouth.

The amounts of nicotine that are taken up by the body from smoking are comparable to the amounts known to have an effect when used in the drug form. The general net effect is to increase the load on the heart.

Carbon Monoxide—About one to two and one-half per cent of the total volume of cigarette smoke is carbon monoxide, while cigar smoke may contain five to eight per cent. The carbon monoxide content increases with the thickness of the cigar or cigarette, with the moisture and tightness of packing and with rapid smoking. Carbon monoxide is absorbed only if the smoke is drawn into the lungs, and inhaling one cigarette results in the saturation of one to one and one-half per cent of the blood.

If a person smokes 20 to 30 cigarettes per day, he may have on the average of four to eight per cent of his hemoglobin so saturated. This amount of smoking results in a 10 per cent saturation in some people. Some delicate functions, such as night vision, are affected at these levels even though headaches and other symptoms of carbon monoxide poisoning do not appear until higher concentrations are reached.

The Physiological Ceiling—Hemoglobin, the pigment in the red blood cells, normally combines with the oxygen in the lungs and transports it to the tissues. Unfortunately, hemoglobin also takes up carbon monoxide in the same way. In fact, when carbon monoxide and oxygen compete for space in the hemoglobin molecule, carbon monoxide is favored by odds of about 210 to one.

Very small concentrations of carbon monoxide can therefore inactivate a large amount of hemoglobin as an oxygen carrier. As a result, a state of oxygen deficiency is produced in the body, which has effects like those of high altitude.

Furthermore, the effects of carbon monoxide and altitude are additive. As a result, a pilot at sea level with a 10 per cent saturation of the blood by carbon monoxide shows the same effects on a sensitive functional test of oxygen deficiency as if he were at an altitude of about 12,000 feet. If he were at 10,000 feet, the combined effect would be equivalent to that of an altitude of 15,000 feet. His ceiling is thus lowered by about 5000 feet.

Furthermore, once carbon monoxide enters the blood, it leaves very slowly. Some 24 hours after heavy smoking, appreciable amounts are still present in the blood. This may partially account for some of the hangover effects of heavy smoking.

Smoking and Altitude Tolerance

Studies carried out in low pressure chambers show that subjects who could tolerate altitudes of 20,000 to 21,000 feet on days they refrained from smoking were able to reach only 16,000 feet when they smoked heavily before the test.

During 1943 the effects of smoking were observed on flight crews engaged in long range operations between Miami and the Far East. Having experienced much fatigue in these flights, air crews agreed to refrain from smoking on the ground and in the air on several trips. Most of the pilots were convinced that they felt less exhausted and more efficient in performing their duties at the cruising altitudes of 8000 to 12,000 feet when they didn't smoke.

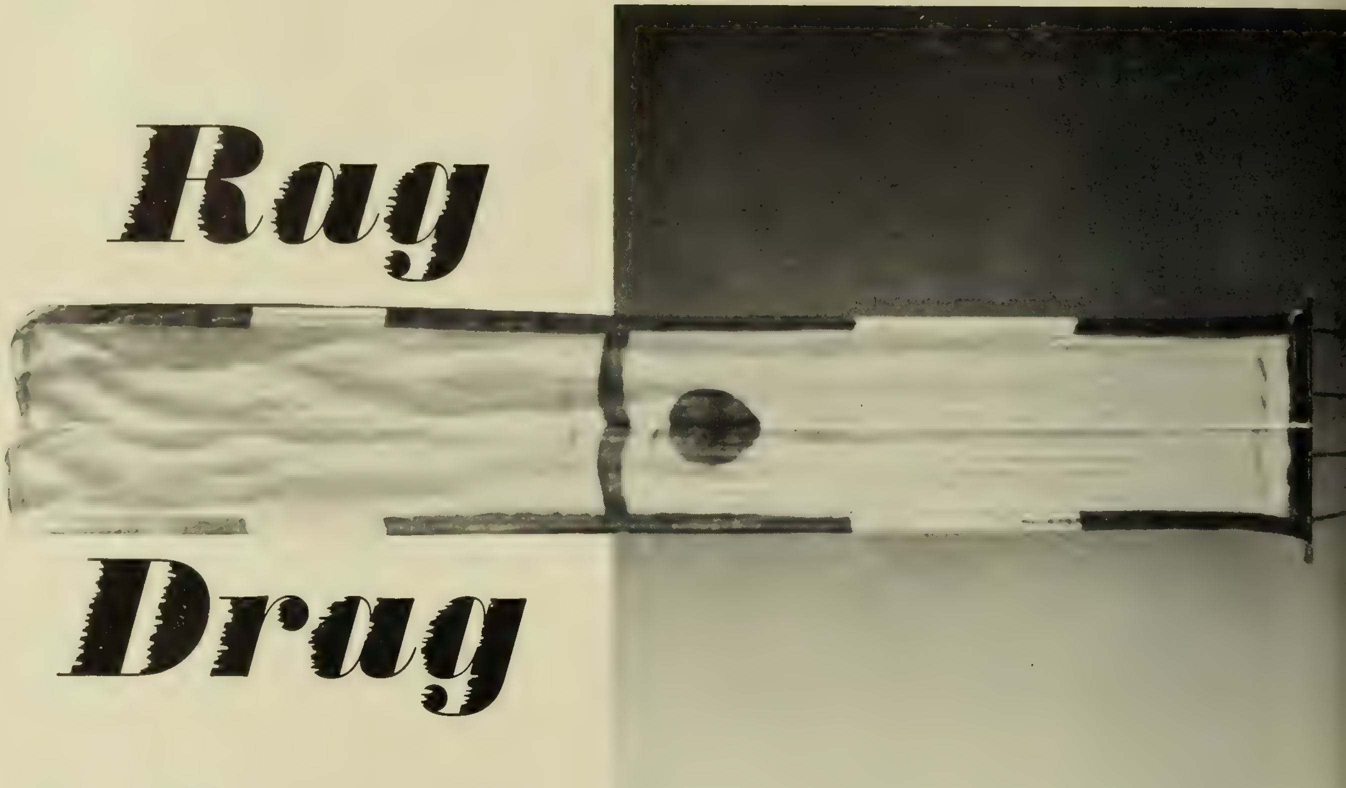
Another factor involved in smoking may also impair altitude tolerance. Nicotine increases the metabolic rate, or the requirement for oxygen, by about 10 to 15 per cent. It has been shown that greater tolerance for altitude accompanies slower metabolic rate. Nicotine also interferes with the action of the autonomic nervous system, the integrity of which is so essential for optimal adaptation to stress.

Smoking and Night Vision—Smoking has an appreciable influence on the ability to see at low levels of illumination; these effects would be of importance particularly on night flights. In my laboratory the sensitivity to changes in the brightness of dim lights was measured before and after three cigarettes were smoked in succession. Blood carbon monoxide increased about one and one-half per cent, the total uptake being about four and one-half per cent. Sensitivity decreased distinctly after each cigarette; That is, lights had to be brighter to be seen. The total effect on vision from only three cigarettes corresponds to that of an altitude of about 8000 feet.

The Airman and Smoking—Not even the tobacco manufacturer claims that the effects of tobacco on the body are beneficial. The question is whether the harmful effects are really serious and great enough to offset the pleasure of smoking. Available evidence indicates that the immediate effects of moderate smoking are probably not harmful to normal adults. Among airmen, however, the impairment of vision and lowered tolerance to altitude present an occupational hazard.

Thus, it would seem wise for pilots to avoid the excessive use of tobacco not only to prolong their useful flying careers, but also to maintain a high degree of fitness in flight. ●

Rag Drag



By Lt. Col. J. C. Giraudo, Commander
USAF Fighter-Weapons School, and
Major E. P. McNeff, Fighter Branch
Directorate, Flight Safety Research.

SINCE the inception of aerial gunnery the launching of a suitable target for gunnery practice has continued to harass fighter operations. The particular problem we are concerned with here is that of towing a target with an F-86F aircraft equipped with the extended (6-3) leading edge wing. The F-86F was equipped with the extended leading edge (hard wing) to improve the high altitude flight characteristics. This gave the Sabre more advantage over the MIG, which was evidenced by the excellent record established by the pilots flying it in Korea.

While the installation of the "hard wing" improved the airplane's maneuverability, it also added a few undesirable characteristics. These are increased takeoff distance, increased stalling speeds and decreased warning before a stall occurs. All of these characteristics increase the difficulties of taking off with a tow target attached. To date six "hard wing" F-86F aircraft have been involved in accidents while taking off with a target attached. In all cases the accidents have been attributed to a stall caused by an excessively nose high attitude immediately after takeoff.

As usual when we are confronted by a problem concerning a phase of aerial gunnery, we checked with the people who know; the USAF Fighter Weapons School at Nellis AFB, Nevada. The personnel at Nellis have been towing targets with the "hard wing" 86 for quite some time and have been very successful.

At Nellis they will tell you that air-to-air gunnery training above 25,000 feet is a definite requirement with today's high altitude interceptors. Not even considering the F-100 and other advanced types, the F-86F was produced to fly at high altitudes, and pilots must be trained in the flying and firing techniques required at those altitudes. The T-33 isn't satisfactory towing a target at 30,000 feet. When any particular T-Bird eventually reaches that altitude, the time required is not compatible with a heavy gunnery program.

The Fighter Weapons School people furnished FLYING SAFETY with the following procedures which they believe to be correct for setting up tow missions using the F-86F.

Pre-takeoff Procedures

- If takeoff is other than in the center of the runway, place the weighted end of the target bar toward the center of the runway. The weighted end

The target should be laid out straight behind the tow ship on recommended "snake-off" method.

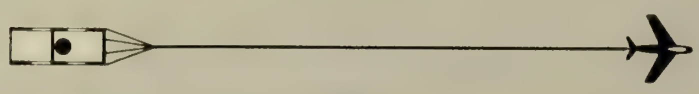


FIGURE I

At Nellis, F-86F tow missions are flown with a standard 6 x 30-foot polyethelene target.

On any tow other than a centerline attachment, a pilot must anticipate a yaw toward the side to which the cable is attached. Before takeoff compensate for yaw by applying some rudder trim.

Ground crewman fastens the 750-foot single, one-eighth inch cable to the tow aircraft.

Establish a normal takeoff attitude. A clean aircraft will break ground at about 130 knots. "A pilot gets into trouble by trying to make his aircraft fly when it is not ready to do so."

of the bar will cause the target to drift in that direction during takeoff, and if improperly laid out, it can cause the target to drift off the near side of the runway, damaging runway lights, snagging or damaging the target, or causing a cable to break. Also, a target dragging through the dirt will impose additional drag on the aircraft, lengthening the takeoff roll and impeding the initial climbout.

- If the tow cable hook-up is any other than a centerline attachment, for example, a wing tow, a pilot must anticipate a yaw toward the side on which the target is attached. Before takeoff a pilot can compensate for this condition by applying rudder trim for two to three seconds in the opposite direction from the side of the tow rig.
- Lay out the target and tow cable in a straight line behind the aircraft for "snake-off" rather than using the 180-degree "snatch-off" method. There is less damage to the cable, harness and target with the "snake-off" method, it eliminates whipping the target experienced with the "snatch-off" method. (See Figure 1)

After a study of tow techniques in F-86F aircraft it was decided at Nellis that there was one main reason for accidents involving this aircraft on tow missions. *A pilot gets into trouble by trying to make his aircraft fly when it is not yet ready to do so.*

The following information on takeoff and climb procedures is based on using the standard 6 x 30 foot A6B polyethelene target with 100 feet of safety webbing and 750 feet of single, 1/8 inch armored cable. (At Nellis, use of 100 feet of webbing has reduced the number of targets lost because of shooting through the cable.)

These procedures, especially airspeeds, are used with average ambient temperatures and a clean aircraft (no external tanks). As temperatures increase, when external tanks are carried or when high altitude runways are used, the pilot must carefully cross-reference the takeoff tables in the Dash One prior to the tow mission.

- Apply 100 per cent power. During the takeoff roll angle gradually toward the center (or upwind) side of the runway.
- At 100 knots IAS, apply back pressure to begin establishing a *normal* takeoff attitude; at 120 knots IAS takeoff attitude is established. A clean aircraft will break ground normally at 130 knots; when wing tanks are installed, it will leave the ground at about 140 knots.

In all cases, allow the aircraft to fly off the ground in a normal takeoff

"Snatch-off" technique results in a whip which causes more damage to cable, harness and target.

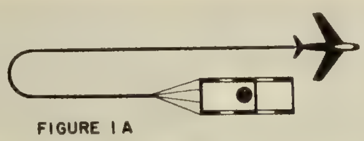


FIGURE 1 A

attitude. Do not pull the aircraft off the runway.

If an emergency occurs during takeoff, get rid of that target! With the F-86 tow rig as illustrated on page 23, have the bomb switches set up so that you can punch off that target right now, if necessary.

When definitely airborne, retract the gear and smoothly attain a 160-knot climb. Use rudder control to eliminate any yaw caused by the target. When 500 feet above the ground, milk up the flaps, anticipating the nose-up pitch change which will occur at this point. Trim the aircraft for the climb out.

For the climb to the target area allow the airspeed to build up to between 170-180 knots and maintain this speed to 15,000 feet. Above 15,000 feet the airspeed must be decreased to between 160-170 knots to maintain the rate of climb. When climbing to above 25,000 feet the airspeed must be further decreased to 155 knots to maintain the proper rate of climb, with 100 per cent power used throughout the climb to altitude.

It is important when climbing to altitude and the firing area to use a minimum number of turns, because the aircraft will not climb well during turns above 15,000 feet.

Tow and Descent

During firing at 30,000 feet the tow speed is 165 knots IAS. Remember, the aircraft flies quite nose high and must be handled gently. Any turns required should be smooth and power must be added to prevent excessive loss of airspeed or burbling.

During the descent do not exceed 180 knots IAS. Release the cable and target, when the tow rig illustrated on page 23, is used. Drop is accomplished over the DZ at 165 IAS. The demo bomb switches are set at MANUAL and ALL and the bomb button on the stick should be depressed when desired. If necessary, upon failure of the bomb circuit to release the cable, a pilot can use his panic button or the manual external stores release handle, or both.

An extensive F-86F towing project was conducted by the Nellis AFB Training Research and Development Section, and the following recommendations were made:

- The F-86F without external tanks installed is a satisfactory tow aircraft up to 30,000 feet. Its use in this configuration will be governed by each unit's distance to the aerial ranges. The closest coordination possible is required between towship and fighters to achieve maximum effectiveness during the towship's fuel-limited time on the range. This is the system used by the USAF Fighter Weapons School, with much success.
- The F-86F with one 120-gallon drop tank installed offers no advantage over a clean aircraft because of the additional weight during climb and additional drag during towing and letdown.
- The F-86F with two 200-gallon drop tanks is a satisfactory tow aircraft up to 20,000 feet maximum. The additional fuel allows double tows at low and medium altitudes. Full flaps *must* be used for takeoff in this configuration and lift-off speed increased to 140 knots IAS.

Experiments at Nellis resulted in adoption of napalm tank displacing strut tow assembly.

- Project tow flights varied in towing speeds from 160 knots IAS to 210 knots IAS using a single tow cable. Two hundred ten knots IAS is a maximum tow airspeed with a single cable, at and above which you can be assured that you will lose the target or cable. Experience here has established that 180 knots IAS is maximum while towing if you desire a satisfactory target return percentage. If you hold your airspeed down to 170 knots IAS for the entire flight, your return percentage increases further, especially during the letdown when the target, webbing and cable have been weakened by bullet impacts.
- A phase of the project incorporated the use of a double tow cable to determine how fast the target could be whipped through the air before it failed. The maximum speeds attained were 260 knots IAS. From 230-260 knots IAS, the target porpoised and leaned, tearing off at the bar near 260 knots IAS. You should not exceed 230 knots IAS, or the target will not remain steady and upright.
- A locally fabricated 9 x 45-foot target was also used during the project. At 20,000 feet, with a clean aircraft and this target, the primary disadvantage was an increase in fuel consumption. Above 20,000 feet, the tow aircraft became unacceptably unstable. Above 230 knots IAS with a double cable, the 9 x 45-foot target tended to fold in the rear one-third. Takeoff with this target and two 200-gallon drop tanks was critical because of the runway length (6500 feet), and the target tore off while dragging through the overrun. The use of the 9 x 45-foot target with the F-86F carrying 200-gallon drop tanks is not recommended.

Standard bomb rack brace, a strut and locally made attaching leader comprise entire tow rig.

- Nellis is approximately 27 nautical miles from the aerial ranges. The ranges are 30 nautical miles long and seven nautical miles wide. The approximate total distance covered during a tow mission is 140 nautical miles. To maintain a fuel margin for landing, under specific conditions, Nellis established that for clean aircraft the set-course fuel minimum on the range is 1500 pounds, and for aircraft carrying drop tanks the minimum is 1750 pounds. No jeopardy of the landing fuel minimum is permitted, and pilots jettison targets if necessary to insure returning with sufficient fuel.

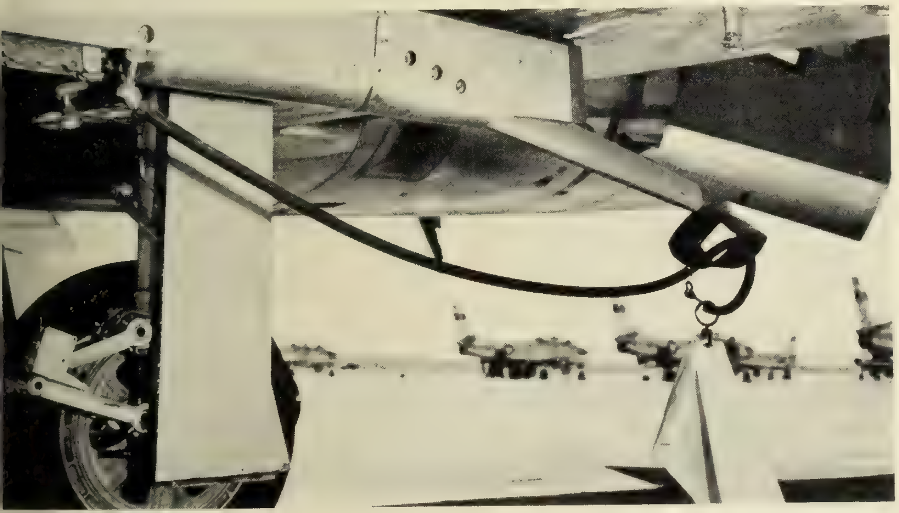
- Although not desired as a regular procedure, on occasion it has been necessary to land with the cable or target due to release malfunctions. If the approach areas to the runways are unobstructed, this poses no particular problem. A slightly steeper final approach, with 10 knots additional final approach speed, if the target is still along, will handle this situation nicely. However, the fact that targets can hang up re-emphasizes the need for good fuel planning to insure a successful mission.

If this procedure is followed, pilots should have no difficulty launching aerial targets with the F-86F. Towing targets in tactical units is considered a normal operation, and at times the tow pilot does not have sufficient information or experience to prepare him for his first tow missions. Squadron supervisory personnel can assist the gunnery program by carefully selecting tow pilots and insuring that they are adequately briefed.

FLYING SAFETY believes that a brief review of the T-33 towing procedures, as flown at Nellis, also may be of value to units engaged in gunnery practice. Towing with the T-33 is certainly not new, but a refresher on salient procedures may increase the success percentage of your present tow missions, as well as possibly precluding undesirable incidents occurring in new units just beginning to tow with the T-33.

The T-33 is an exceptionally satisfactory tow aircraft up to 20,000 feet. Above this altitude the rate of climb deteriorates to such an extent that the time-fuel factor becomes significant.

At Nellis, we use 175 gallons in each tiptank of the T-33 to allow for double-tow missions. With this load two fighter flights can complete their gunnery, and the T-33 still has plenty of fuel for return, drop and landing. The double-tow procedure is primarily one of maximum utilization of a limited number of T-33s. If your unit is not pressed by a shortage of T-33s, we strongly recommend single-tows for two reasons: First, you always stand the chance of the second flight on the target shooting it off. This loses the unit two flight gunnery missions, whereas on single-tows the first flight normally would have recovered its target. The second reason is the never-ending fighter pilot hassle that you get into from scoring a target loaded with eight-colored holes. Today's ammo paint is far from infallible; red can look like orange, brown can look like purple, and so on. Single-tows using your best painting colors virtually eliminate this confusion.


The attaching leader is passed through the guide and the release ring is hooked into the shackle. The aft end of the leader is temporarily wired around the guide, until tow cable hookup is made.

Takeoff, as with the F-86F, is with 100 per cent power and 30 degrees flaps. During the takeoff roll, angle toward the upwind side of the runway to save the runway lights, target and so on.

At 100-110 mph (87-96 knots), apply back pressure to ease the nose up, relieving the weight from the nose gear. At 130 mph (113 knots), consistent with runway temperatures, altitude and aircraft feel, fly the aircraft off. When 40-50 feet above the ground, retract the gear.

Smoothly establish a 150 mph (130 knots) initial climb, holding this until approximately 1000 feet above ground or when notified that the target is well clear of the runway.

At this time, milk up the wing flaps, anticipating the pitch change, and allow the airspeed to smoothly build up to 190 mph (165 knots) for the climb. Do not exceed 190 mph (165 knots) during the entire towing mission.

As with the F-86F, climbing airspeed must be decreased gradually with altitude in order to maintain a climb. At 15,000 feet you will be climbing at 170-180 mph (148-156 knots); at 20,000 feet the airspeed will be down to 165-170 mph (143-148 knots). Each pilot will recognize his best climb airspeed for his particular T-Bird at the increasing altitudes.

Again, hold the climbing turns to a minimum and make all turns gradual and smooth.

After level-off, allow the airspeed to increase to 190 mph (165 knots), and hold this for the entire firing period. In event that the fighters report a leaning target, a slight decrease or increase in airspeed usually rights the target. A decrease in airspeed will usually right a target which has lost its weight and is leaning. Notify the fighters of all significant changes in towing airspeed.

Upon completion of firing, a normal letdown is made, again not exceeding 190 mph (165 knots). The drop is made at 180-190 mph (156-165 knots), as it has been found that more successful releases are made at the higher airspeeds.

With the tow rig used at Nellis, target release is made by pulling the Jato Jettison Handle. When ready to drop, pull the handle and cable full out, giving a sharp pull during the last part of the cable travel. We have had much success releasing targets with our present procedures and rig.

In the event that a landing with the target is necessary, use a slightly steeper final approach, carrying 150 mph (130 knots) throughout the final. Aim for a spot about one-third down the runway and your landing should be uneventful. Don't hold the aircraft off until its dying breath, because as soon as the target hits, you decelerate in a hurry. ●

Keep Current

NEWS AND VIEWS

Another Foamite Save — Thirty-five hundred feet of foam, spread on a runway, saved over one-half million tax dollars, plus the possible loss of an F-94C combat crew, at Hamilton AFB recently.

The F-94C, piloted by 1st Lt. Ward G. Tuttle, 84th Fighter-Interceptor Squadron, was on alert, and was deployed to McClellan AFB. The landing at McClellan was completed without incident.

After being released to his home station (Hamilton), Lt. Tuttle noticed terrific vibration and experienced extreme difficulty in maintaining directional control of the aircraft during takeoff from McClellan. When airborne, Lt. Tuttle retracted the landing gear and the warning light on the panel gave him an unsafe indication. He immediately lowered the gear and radioed to his wingman to look over the aircraft to see if it was clean.

His wingman notified the pilot that the two main landing gears were twisted to a 90-degree position. Lt. Tuttle immediately reported the condition to "home plate" at Hamilton. Major Marvin W. Miller, commander of the 84th received the call and alerted the crash crew, requesting them to spread foam on the runway.

The squadron commander then proceeded to the mobile control unit and advised Lt. Tuttle of the preparations, and to land with cocked wheels on the foamed runway.

Lt. Tuttle touched down on the foam, skimming for 2500 feet to a stop. The instant the aircraft landed, the pilot blossomed the tail chute. This, of course, aided greatly in stopping the '94.

After inspecting the damage to the aircraft, it was announced that it would take approximately three man-hours for complete repairs. The tires were blown and two inches of the wheel rims were ground away.

After sliding 2500 feet with its main gears cocked at a 90-degree angle, this F-94C came to a stop with two tires blown. Landing was possible because of 3500 feet of foamite spread on runway.

Radar Height Finder—The development and production of a new radar height finder that will help strengthen defense networks of the United States, was announced by ARDC recently.

The new set was developed by ARDC's Rome Air Development Center in conjunction with the General Electric Company of Syracuse, New York. It meets the need for greater radar range, concentrates the radar energy in a narrow beam like the rays of a searchlight and can detect planes almost three times as far away as previous units of this type. The new set is used with search radar to detect high-flying aircraft, providing information on distance, altitude and direction of flight.

Magic Numbers — There are two magic numbers in this old world of ours. Two numbers that mean hope for the lost and aid for the stricken. The first is 500. The second is 8364. Both represent the life-saving kilocycles assigned to transmit SOS signals.

Ever since Professor Marconi put the wireless business into operable

The F-86K, a cannon-firing version of the F-86D interceptor, is an all-weather fighter featuring four 20-mm cannon instead of the 24 Mighty Mouse rockets of the 'D, powered by a J-47 engine.

reality, that one distress signal has been pretty much standardized the world around. The transmission of an SOS immediately gets results. Direction finders seek bearings, aircraft leap off and ships at sea swing onto new courses. An SOS demonstrates that man still has a lot of humanity in his soul.

False distress signals are inexcusable. Seldom does anyone send a phony SOS deliberately, for punishment is swift and sure. However, there have been occasions when distress signals were sent accidentally.

Recently an aircraft ditched in the ocean near the coast. Foul weather hampered the air and sea search considerably. Would-be rescuers hoped constantly for a distress signal, anything that could be used for homing in on the downed flyers.

Now here is where we get into the accidental transmission act. Searchers did receive a signal that apparently came from the vicinity of the ditched plane. Unfortunately it was not sent by survivors. Instead, Air Force personnel testing a Gibson Girl were the guilty ones.

The Gibson Girl (Radio Set AN/CRT-3) is a hand-cranked, two watt transmitter which automatically puts out SOS signals alternately on 500 and 8364 kcs. Obviously the set should not be allowed to put out a signal of any magnitude while being tested.

When testing, never connect the antenna with the antenna lead-in to the set. Without that little hook-up, the signals that are transmitted will carry but a few feet.

If there is still an element of doubt in your mind as to the hows and whys of the Gibson Gal, see your Personal Equipment Officer.

A New Record—A new record for high altitude parachute jumps has been set by two U. S. Air Force officers who parachuted safely from a modified B-47 at 45,200 feet.

The record jumps, which were made by Capt. Edward Sperry and 1st Lt. Henry Neilsen over the Gulf of Mexico, utilized the new type downward ejection seat. The temperature at 45,200 feet at the time of bail-out was —37°C.

The old parachute record of 42,000 feet was set in August 1950 by Major Vincent Mazza of the Wright Air Development Center.

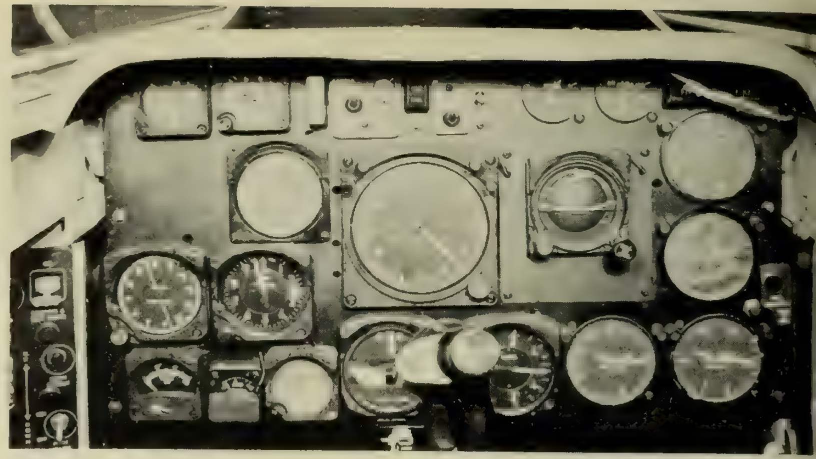
Know Your Areas—Changes in the terminology describing airspace restricted areas became effective 9 December 1954. Part 60 of the Civil Air Regulations has been amended by the Civil Aeronautics Board to eliminate the terms *danger area* and *airspace restricted area* and replace them with the terms *restricted area* and *prohibited area*, respectively.

A *restricted area* is defined as: Airspace identified by an area on the surface of the earth within which the flight of aircraft, while not wholly prohibited, is subject to restrictions.

The provisions provide that *prohibited area* be defined as: Airspace identified by an area on the surface of the earth within which flight of aircraft is prohibited.

Use of the J-44 engine may boost C-82 takeoff and load performance.

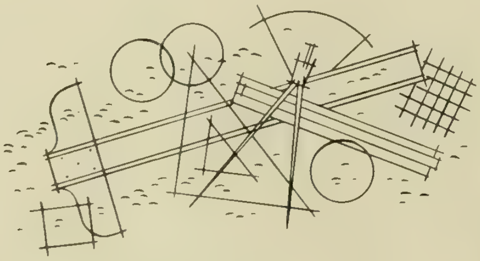
Boeing's 1000th B-47 built for the Air Force, makes initial test flight.

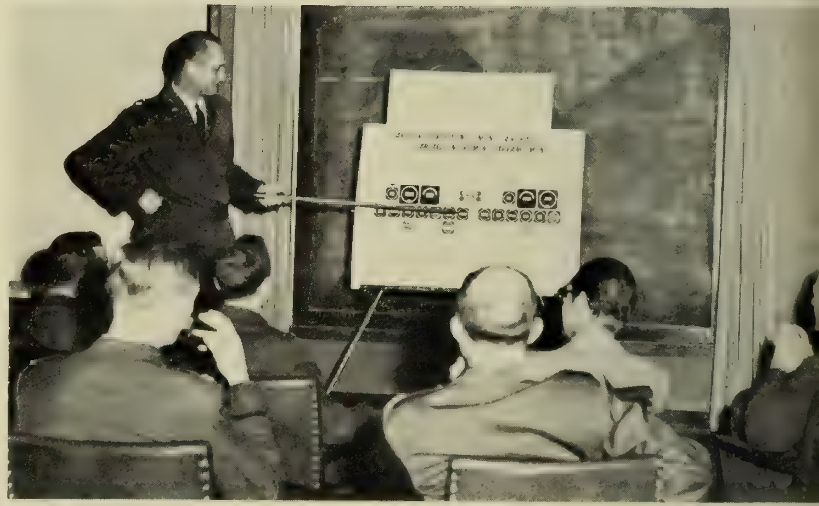


Specialists representing each of the major commands aid in . . .

Designing the Office—

Research and development are conducted to determine the criteria for aircraft crew stations with regard to the location of controls, lighting and arrangement of instruments, dimensions and vision.





BACK in July 1954 FLYING SAFETY devoted eight pages to what we thought to be a vitally important subject. Titled "Operation Standard," the article was a rather comprehensive discussion of the current efforts to standardize the cockpits of military aircraft.

Evidently this subject was of considerable interest to our readers, for we have received quite a bit of correspondence from the field requesting further information. Consequently, we're running this article about the people and organizations behind the standardization program.

Basically, the plan is to design our cockpits in such a manner that a pilot may switch from one type aircraft to another with a minimum of effort. Flight instruments should be the same in the B-47 as in the B-947 (whenever it arrives on the scene). Control knobs are being designed that simulate their functions. A wheel-shaped knob for the landing gear, an airfoil-shaped handle for the wing flaps, and so on.

This is a serious subject these days, particularly in view of our complicated cockpits in high-speed aircraft, and everyone who participates in the design or acceptance of a new airplane must take standardization factors into consideration.

Before fabrication of an aircraft begins, the cockpit, crew stations and many times the entire airplane are completely mocked-up in full scale to ascertain that everything will fit together as planned.

A formal inspection of the mock-up is made by representatives of the commands that will use the aircraft. Comments and requests for changes are submitted to the Mock-Up Board, which is composed of a member from each organization concerned.

At times the controversy wages hot and heavy, for the first airplane will be built in the configuration approved by the Board. The discussion usually gets the warmest when it concerns the arrangement and actuation of controls and instruments in the cockpit.

This controversy continues to a milder degree throughout the life of the aircraft, sometimes producing retrofit programs which might have been unnecessary if universal agreement had been reached in the original design.

In order for the functioning of the Major Commands Crew Station Advisory Group to be properly understood, it is necessary first to explain the procedure used in determining criteria to be followed in the design of aircraft crew stations.

It is the responsibility of the Aircraft Laboratory of Wright Air Development Center to conduct research and development to determine the optimum design criteria for aircraft crew stations with regard to the location and actuation of controls, instrument arrangement, instrument lighting, crew station dimensions and vision. These criteria are placed before a WADC steering committee in the form of recommendations. Items approved by the committee are published in ARDC Manual 80-1, The Handbook of Instructions for Aircraft Designers, commonly referred to as the HIAD.

The HIAD is the basis of design to which all USAF aircraft must be built and includes a multitude of details. It covers such subjects as desired aerodynamic characteristics, control systems, instruments and color of aircraft interiors — in brief, the entire plane.

The HIAD is sectionalized and contains referenced drawings which specify such criteria as:

- The distance of the control column or stick from the seat.
- The maximum amount of control throw allowed.
- The distance from seat to the rudder pedals.
- The amount of rudder pedal travel and adjustment.
- The arrangement of instruments.
- The location and actuation of engine controls.
- The location and configuration of the fuel controls.
- The location and type of the armament controls.

When the criteria for a control or an instrument are being set up, the following process usually is observed: The problem, with or without a proposed solution, is presented to a subcommittee composed of representatives of the pertinent laboratories and of Flight Test. If necessary, a research or development and flight test program is conducted. After a sound solution has been reached, appropriate recommendations are made to the WADC steering committee. The design criteria, as approved by the steering committee are incorporated in the HIAD.

To assist in discharging the responsibilities of WADC with regard to crew station design criteria, authority to establish the Major Commands Crew Station Advisory Group (MCCSAG) was given to WADC in April 1954. This group, which had its initial meeting in August 1954, advises WADC of requirements, preferences and opinions with regard to crew station design.

This group is composed of one member from each major command and has two WADC chairmen; the Chief of the Aircraft Lab and the Director of Flight and All Weather Testing. The group meets once every six months, and each member is requested to commit his command to agreements regarding criteria to be included in the HIAD.

Under the MCCSAG, three subgroups operate; one each for fighter, bomber and cargo type aircraft. The sub-groups meet as required, at least once between each meeting of the MCCSAG, to discuss requirements and standardization in detail. Each sub-group is composed of members of commands that have special interest in that particular type aircraft.

The sub-group member is responsible for setting up within his command a program by which he can obtain pilot opinions, results of flight tests, field operational practices and recommendations. He prepares questionnaires and other aids which help him to reach a conclusion. His objective is to arrive at a command stand on any particular problem. Pertinent recommendations are then submitted by MCCSAG to the WADC Aircraft Crew Station Steering Committee for incorporation in the HIAD. Coordination between the steering committee and advisory group offers no problem, since the chairman of the two groups is the same individual.

It is evident that the requirements for crew station arrangement that are in the HIAD are not the result of snap decisions, but are the outgrowth of study, experience and many conferences. The project to standardize cockpits was authorized by Headquarters USAF in 1946 and has been continuous ever since.

Pilot opinions, UR recommendations, new concepts, new flying techniques and new requirements must all be tempered by a sound engineering approach applicable to all airplanes, with a view toward standardization. It is obvious that standardization between types of airplanes can only be carried to a certain degree. The inherent differences between fighter, bomber and cargo types, coupled with their different mission requirements, greatly influence all considerations of universal standardization. The similar controls, instruments, dimensional requirements and related functions for all types must be welded to the dissimilar configuration of each type. This must result in the best possible installation for each type, while retaining the basic ideas of location and actuation necessary to preserve standardization.

Before any item is added to the HIAD, it is approved by a committee composed of a representative from each Laboratory, and from Flight Test at the WADC. Since March 1954 the committee which approves standardization criteria to go in the HIAD has been known as the Aircraft Crew Station Steering Committee.

This steering committee inspects mock-ups to suggest necessary changes or to give its stamp of approval, as applicable. Another very important function of this committee is to make recommendations regarding the display or presentation of all instruments that go into the cockpit of an aircraft.

In addition to this committee, various standardization committees have operated for some years on an interservice and international level.

The Cockpit Layout Panel, formerly operating as a panel under the Munitions Board and presently operating under the auspices of the Aeronautical Standards Group, is composed of members from the Air Force, Navy, Army, Civil Aeronautics Administration and the Civil Aeronautics Board. Through the operation of this panel, interservice agreements regarding cockpit standardization are made.

International standardization agreements are achieved through Working Party 16 of the Air Standardization Coordinating Committee. This group is composed of members from the military services of the United States, Great Britain and Canada. Agreements reached in this group are published as ABC standards.

Continuity of action and agreement among these various committees is maintained by having the same personnel of the USAF serve on all committees, either as members or technical advisors.

Through the medium of the Major Commands Crew Station Advisory Group, the using commands can exert more influence in the establishment of design criteria to be published in the HIAD. It is hoped that this will eliminate much of the disagreement experienced in the past at mock-ups by providing criteria that will represent a satisfactory compromise to all interested agencies. ●

Concrete Ski Trails

Capt. Alvan Bruch, AWS

WELL, here we are with winter at least half gone and even the snow-bound are dreaming of spring flowers and green grass. The white stuff on the runways is a menace that we must continue to fight with all available equipment.

By now the story of snow removal is familiar to all of those who have to live and work in the northern areas of our country. The story will continue for the rest of the winter with the receipt of each advance warning from the weather forecaster.

Twelve hours notice guarantees that the equipment will be ready to roll before two inches have accumulated. Priorities are assigned so that the prevailing-wind runway is cleared first.

If the airport is a secondary field with little traffic and accustomed to quite a bit of snow, the snow may be compacted by rollers. If the precipitation has been sleet or freezing rain instead of snow, the sanders do the job instead of the snowplow. With proper alert and a good plan, the job is quickly and effectively done, and so ends the story.

It's a beautiful story, but it doesn't always work that way. The alert system might fail. The first sign of a developing storm is often the spreading out of a precipitation area. A well-developed storm may veer suddenly off its established track. A very slight difference in temperature above the station may mean the difference between a cold rain and snow.

There are other reasons why the story might not have a happy ending. Snow falling with temperatures well below freezing is usually dry and doesn't stick to runway surfaces or removal equipment. If it doesn't fall at too fast a rate, it can be removed easily. If it falls too fast or if it is accompanied by high wind, the removal operation is apt to run several hours beyond the end of the storm.

Snow falling with temperatures right around freezing is usually wet. Wet snow is heavy and sticks to runway surfaces. Equipment is slowed down by the sheer weight of the snow and breakdowns are frequent. If the temperature drops while the wet snow is still on the runways, an almost impossible situation results. The use of sand or chemicals is restricted to emergency conditions. Jets with low scoops will pick up the sand, and the particles will clog the runway drainage system. Chemicals will corrode the fuselage and damage the runway.

It seems realistic to assume that every pilot will at some time be faced with the problem of handling a plane on a runway loaded down with snow or ice. The problem has no exact solution, but a study of the effect of the variables and thoughtful flight planning minimizes the difficulties.

Most of us have seen a dog chasing a stick across a frozen pond. He flails madly at the icy surface trying to get going, then he usually slides right past the stick on his *derriere*. The point is, traction is not required for aircraft acceleration because the thrust is derived from the air and not the ground, but traction is required for bringing the plane to a halt before you run out of runway.

Traction, or wheel friction, does play some part in the takeoff. Deep, loosely packed snow gives increased drag—maybe so much drag that you reach the end of the runway before you reach flying speed. Hard, compacted snow or ice gives practically no drag but some wheel friction is required to help fight cross-winds. Usually the control surfaces will do the job and if you have more than one engine, power adjustments will see you through, but a little friction at the wheels is a lot of help.

The problems in landing are more varied. The glare of clean snow may reduce a pilot's ability to maintain the heading or bearing of the runway. Marker dye helps out here, but depth perception may also be affected. Initial contact in deep, loosely packed snow is far from desirable. The pitching moment may be increased to the point where it exceeds the moment of stability of your plane. When this happens, you nose over; or in an aircraft equipped with a tricycle gear you risk snapping the nosewheel strut.

Once on the ground you have the cross-wind problem again, and banks of snow cut down the allowable drift. Finally, you have to stop. When the friction at the brake drum exceeds the friction at the ground, you skid. Sounds a bit hairy, doesn't it? Well, it can be if you fail to plan ahead. A pilot who goes blundering into a field where landing conditions are unknown is really asking for it. It would appear that a few drivers were never exposed to the NOTAM system.

There are a few more things to consider also. You should make sure that you have braking action before you try to taxi. And watch those snow banks. Warm-up areas are usually sanded, but, if a jet preceded you, you may find that it melted the snow a little and that it's frozen again by the time you get there. Wet snow or slush is especially hazardous when it clings to your gear and freezes when you carry it aloft.

The operations officer at every base knows the condition of his runways. He isn't quiet about it, either. A check of the NOTAMS will tell you whether or not they are usable. He also estimates the amount of braking action you can expect. The weather forecaster will alert you to the possibility of fresh snow or other precipitation at your destination. Your last chance to check runway condition prior to landing is by contacting the tower.

Always do that before touching down on a strange field. You'll find that quick check with the tower may really pay off. ●

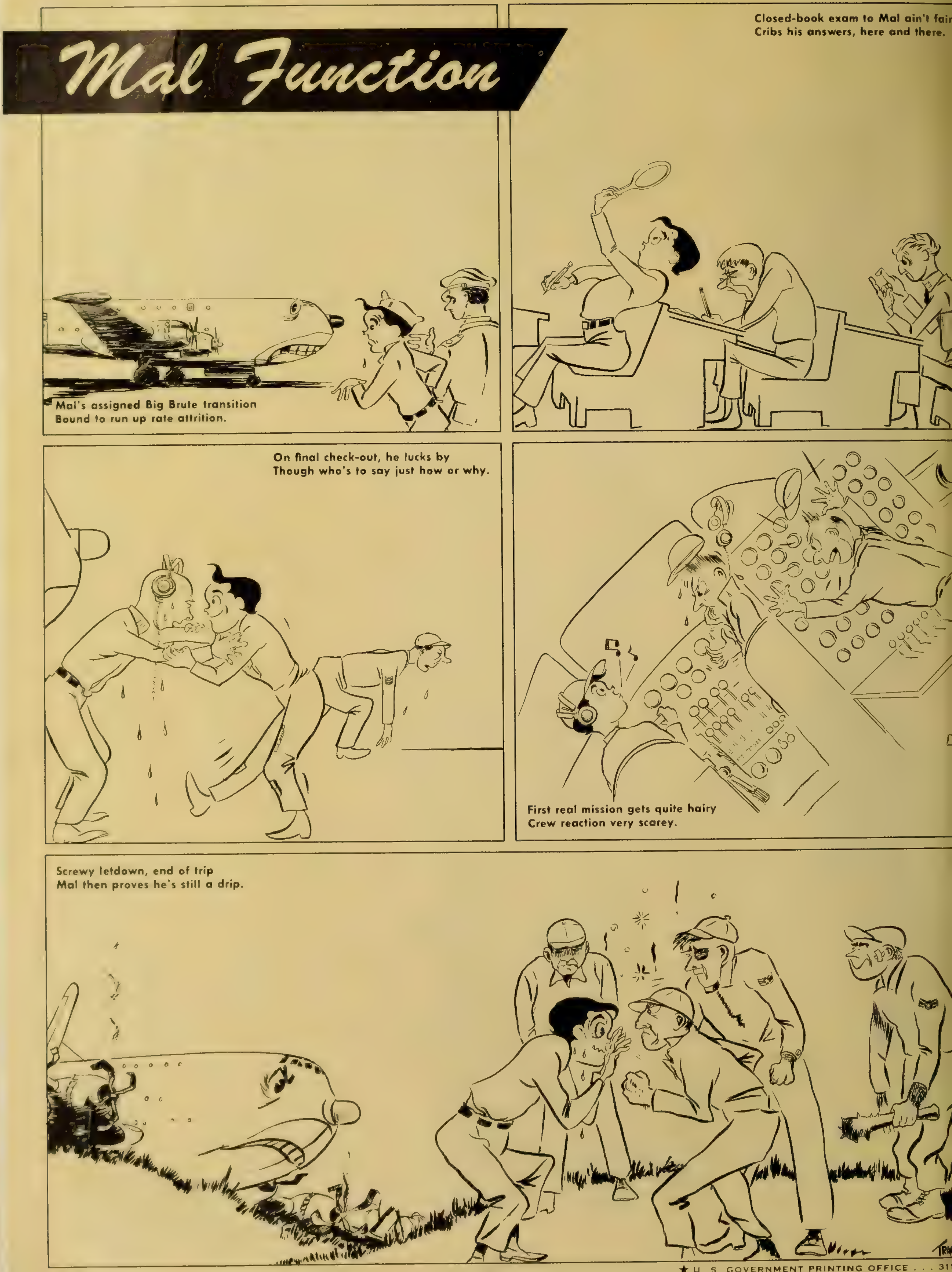
the Smoking Lamp is Lit ——

If you're like most of us, you probably gulp when you look at a little doll like this. Reflexes you know. And by the same token we'll bet you gulp down your share of smoke every day, too.

No, we haven't joined the bandwagon. We're not crusading against the filthy weed. Nor do we take issue with current claims both pro and con. Editorially speaking, we're completely neutral on the subject. However, the article on page 18 of this issue may cause you to pause and think.

Of course, if one could find anything as lovely as this lovelie . . . far removed from all sky chariots, one might be forgiven for smoking just a little.

Mal Function


Mal's assigned Big Brute transition
Bound to run up rate attrition.
Closed-book exam to Mal ain't fair
Cribs his answers, here and there.
On final check-out, he lucks by
Though who's to say just how or why.
First real mission gets quite hairy
Crew reaction very scarey.
Screwy letdown, end of trip
Mal then proves he's still a drip.
TR

★ U S GOVERNMENT PRINTING OFFICE . . . 31

29.1305
LYS

March 1955

FLYING SAFETY

UNITED STATES AIR FORCE

THE LIBRARY OF THE
APR 1 [illegible]
UNIVERSITY OF [illegible]

DELTA - FOXTROT
GOLF - COCA - INDIA

pages
4 to 11

FLYING SAFETY

VOLUME ELEVEN NUMBER THREE

Department of the Air Force
The Inspector General USAF
Major General Howard G. Bunker
Deputy Inspector General

Brigadier General Richard J. O'Keefe
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

Maj. Philip A. Watson, Jr.
Acting Supervisor of Flight Safety
Publications

Editor
Maj. Joseph P. Tracy

Managing Editor
Capt. John H. Moore, Jr.

Associate Editor
Maj. Perry J. Dahl

Art Editor
M/Sgt. Steven Hotch

Production Assistant
T/Sgt. Carl E. Fallman

Staff Photographer
T/Sgt. Nicholas Shekitka, Jr.

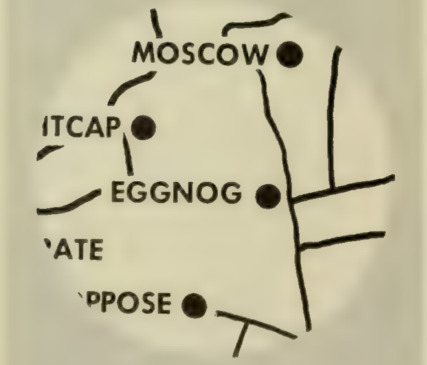
Circulation Manager
T/Sgt. G. J. Deen

CONTENTS

Page

Crossfeed 2
Lost — Misplaced — Disoriented 4
Is It Working? 12
Well Done 14
Tiger Trainer 16
Get The Full Treatment 19
Tomorrow's New View 20
Keep Current 22
The New Approach to Rough Air 24
When You're In The Soup 26

LOST?
see page 11



SUBSCRIPTIONS

FLYING SAFETY magazine is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished.

* * *

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 3 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in *Flying Safety Magazine*. Contributions are welcome as are comments and criticisms. Address all correspondence to the Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

Major General Victor E. Bertrandias

Deputy Inspector General
USAF, (Inspection)

- Directorate of Flight Safety Research
- Directorate of Readiness and Materiel Inspection
- Directorate of Procurement Inspection

General Bertrandias retired from extended active duty last month following thirty-seven years of active and inactive service. During retirement ceremonies at Norton Air Force Base, California, General Bertrandias received the Distinguished Service Medal in recognition for his service in the Office of The Inspector General, USAF. The award was made by Lt. General Truman H. Landon, The Inspector General, USAF.

General Nathan Twining, Chief of Staff, USAF, in a letter to General Bertrandias, presented him with a USAF Flight Safety Plaque — originally developed by General Bertrandias for presentation to USAF organizations for outstanding safety records — for "outstanding contribution to the Air Force Flight Safety Program."

During the past five years General Bertrandias has been responsible for the world-wide activities of the Directorate of Flight Safety Research as well as the Directorates of Readiness and Materiel Inspection and Procurement Inspection.

The staff of *Flying Safety Magazine* and the officers, airmen and civilian employees of the Office of The Inspector General, USAF, join in wishing General Bertrandias continued health and happiness and extend sincere congratulations for his years of distinguished service to his country and the United States Air Force.

LETTERS TO THE EDITOR

The Erring Altimeter

Reference is made to the December 1954 issue of FLYING SAFETY, and particularly to the following paragraph of the interesting article, "Plan It—Fly It," page 9:

"Inherent error in altitudes at high speed is a problem, but there is a simple rule-of-thumb method for compensating for error that can be used. For every mile per hour increase in airspeed over 200 mph, the altimeter will indicate one foot too high. As an example, at 600 mph the aircraft will be 400 feet lower than the altimeter reading."

This rule is a safe rule inasmuch as it helps to provide an additional safety factor in the clearance of ground obstacles. However, it does not provide a sufficient amount for some aircraft and it is not universally applicable to providing safe vertical separation of aircraft on the airways under IFR.

The rule-of-thumb may apply very well to a particular model of airplane but will apply in an opposite way to another model. There is a wide variation between models even in the same family of aircraft. The F-84B differs from the F-84F. It is suggested that the particular model of aircraft and altitude of flight be mentioned for this rule-of-thumb, such as: Model F-94C at 10,000 feet. It does not apply to the model F-89C or the model B-47 which have static port installation errors with an opposite sign.

The Dash One Flight Handbook should be consulted where the error is tabulated for some aircraft.

While this error is excessively large in some military aircraft it also exists in commercial transports and is the subject of increasing concern by ICAO, IATA, CAA, various foreign governments and various airlines. In the DC-6 at 18,000 feet this error approaches minus 250 feet at cruising conditions while in the Constellation L-749 under the same conditions the error approaches plus 200 feet. In the last two years there have been more than six instances of near-collisions on the airways where a DC-6 was supposedly flying 1000 feet higher than a Constellation on the same route. When the Constellation is assigned to fly a level 1000 feet higher than a DC-6 the actual clearance probably is more nearly 1500 feet. The application of the rule-of-thumb mentioned in FLYING SAFETY will not help a situation like this. An individual rule for the DC-6 and a second more correct rule for the Constellation are necessary to prevent these near-collisions.

Another rule-of-thumb regarding this error which is also significant is that the value of the error in terms of feet of pressure altitude is doubled for each increase of altitude of 18,000 feet. In other words, at 18,000 feet the value of this error is double the value at the same indicated airspeed at sea level conditions and at 36,000 feet (actually at 33,500 feet) the value is four times that at sea level. At 54,000 feet (actually at 48,000 feet) the value of the error is eight times that encountered at sea level at the same indicated airspeed.

Lt. Col. John G. P. Callahan
Directorate of Research and Development, Office DC/S

★ ★ ★

More T-Bird Tips

This unit is interested in obtaining any material available on the effects of gun access doors on T-33A aircraft opening during takeoff or during flight and what counter-measures pilots should use to help assure a safe landing.

Any information or publications you may furnish us regarding this matter would be greatly appreciated.

Your article "T-Bird Tips" in the November 1954 issue of Flying Safety Magazine has been made mandatory reading for pilots of this organization.

1st Lt. Hal W. Morrill, ANGUS
FSO, 116th F-I Sq
Geiger Field, Spokane, Wash.

This is in answer to your request for information available on the effects of gun access doors on T-33A aircraft opening during takeoff or while in flight. This office has a draft copy of the proposed revised edition of the T-33A Flight Handbook (T. O. IT-33A-1) which has been approved by Wright Air Development Center (WADC) and will be published in the near future. Included in Section III of the handbook are the following instructions and procedures recommended in event of the opening of the armament hood doors during takeoff or while in flight:

"The armament hood doors have been known to come open in flight. Almost invariably, the reason is that they were not locked prior to takeoff. If they are not locked they usually will start to come open just as the aircraft leaves the ground on takeoff at 120 knots. If they do, drop the dive flaps. The sucking action thus induced by the dive flaps helps to hold the doors closed. Get the air-speed above 130 knots as soon as possible.

"The armament hood doors normally will stay closed at airspeeds above 130 knots and below 215 knots. Make gentle turns, jettison the tip-tanks if over one-half full and come back in to land. Fly the final approach at 140 knots and bring the aircraft down very close to the ground before leveling out. Be cautious. Do not balloon or attempt to spike the aircraft on the runway.

"In the event the armament hood doors come open in flight, lower airspeed immediately by dropping dive flaps and reducing power."

The above procedures were established by Flying Training Air Force, *Air Training Command, and are based upon experience within the command. The procedures were approved after further study by WADC and although they have not been published as yet, may be considered as official.*

I would be obliged if some additional information could be forwarded to me with regard to an article in the November 1954 issue of Flying Safety. Reference is directed to page 6, *T-Bird Tips* by Major James A. Jimenez.

During the course of the article much attention is directed to malfunctioning tip tanks. In particular I am rather vague as to how tip tank feeding is readily determined by checking the aileron trim. Granted, excessive aileron trim (up or down) will be a definite indication of one tip feeding faster than the other, or not feeding at all for that matter, but the big question that enters my mind is, "Which tip tank is the heaviest?"

The trim tab location will tell me which wing is heavy, but does this mean the tip tank on that wing is yet full of fuel? I have had occasion to believe that the tip tank opposite the heavy wing would be the one with more fuel.

Additionally, I would like to know which wing will have the greatest lift at the instant one tip tank may have to be jettisoned.

Your cooperation and concern in the above questions will be gratefully accepted.

1st Lt. Robert Ball
Craig AFB, Alabama

If the aileron trim tab is toward the up position, it means that you have added trim to hold the right wing down. The left tiptank is malfunctioning, causing abnormal left wing heaviness. If the trim tab is deflected downward, the right tiptank is malfunctioning and causing the right wing to be the heaviest. When in doubt, actuate the aileron trim tab slowly to the neutral position. Unusually heavy stick pressure will indicate which wing is the heaviest. Be sure to move the trim tab very slowly and make sure that you can maintain control of the aircraft satisfactorily with the trim tab in neutral.

In regard to wing lift, a wing with a tiptank installed has greater lift than one without a tiptank. The difference in lift is negligible, however. The amount of fuel in the tiptank means increased weight at the outer end of the wing. This brings up another point. If you have to jettison a heavy tank, be sure to have the aileron trim as close to neutral as possible. If you have full left aileron trim rolled in to correct for a heavy right wing, the aircraft will roll quickly to the left at the instant that the right tank is jettisoned. You must neutralize the trim as much as possible before jettisoning and anticipate a roll to the left when the heavy right tiptank is jettisoned. Be ready to apply firm stick pressure to the right at the instant the tiptank goes.

★ ★ ★

Cross-Wind Computer

Many airfields presently in use have only one runway or one primary runway, hence it is often necessary to make cross-wind landings. A knowledge of the actual amount of cross-wind present is essential. As cross-wind operations become more common, wind can be given by the control tower in terms of cross-wind component with respect to the runway assigned. Meanwhile, it is necessary for the pilot to compute the cross-wind component from information furnished by the tower, i.e., landing runway and wind direction and velocity.

I am enclosing a cross-wind component computer which I developed and made for use here in the Azores where often we have to contend with a strong cross-wind component before landing. This computer is held together with a thumb tack (rather than the rivet type fastener normally used) so that it may be disassembled easily for inspection and/or photographing of the two parts for possible reproduction in FLYING SAFETY.

This computer was made photographically and then laminated in plastic. This method of production is not completely satisfactory, as the photographic paper is stretched in the process of lamination, and the finished product, while still accurate, becomes distorted and somewhat difficult to read on certain settings. Also, when carried in the pocket (for which it was designed), body heat causes the light plastic to warp, shortening the effective life of the computer.

All necessary instructions are printed on the computer. For example: Runway in use is 32, with wind from 020° magnetic at 25 knots. Place 020° (wind direction) under 32 (runway heading) and opposite wind speed of 25 knots. Read cross-wind component of 21 knots. The wind is from the right on landing, so you have a 21-knot component from the right. Yes, the component can be computed on the reverse side of the E-6B or on the AN-01-20-CAC-1 cross-wind component chart, but neither of the above provides an easy and instantaneous method of computing the component, and in addition, each requires a certain amount of interpolation. This computer is simple and easy to use and provides an instantaneous computation which is read directly from the face of the computer. Try it and see.

As mentioned before, this computer was developed to fill a local need and was constructed out of the material at hand. However, it is felt that it may fill a more universal need, or rather I should say that it might fill a more universal need if it were available. It is further felt that this computer could be easily mass produced, either on metal or a plastic or fiber compound which is not affected by changes in temperature.

This computer is submitted for your evaluation and possible dissemination of the information to others through your magazine.

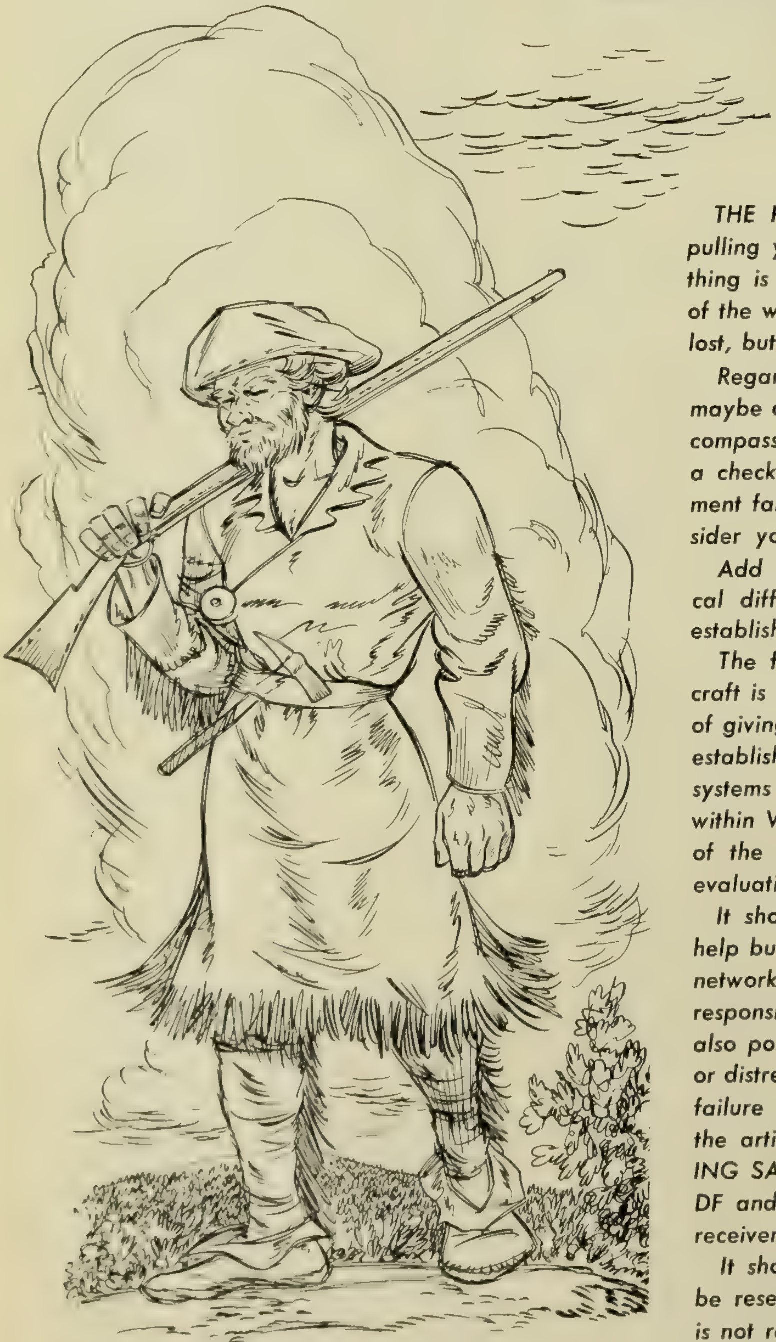
Anyone interested in further information on the construction of these computers can write to me c/o 57th Air Rescue Squadron, APO 406, N.Y.

Major Parker B. Mudge
Operations Officer.

Looks good to us. If you have any questions the man gave you his mailing address.

This computer enables a pilot to figure the cross-wind component rapidly and accurately.

Lost—Misplaced—Disoriented—



THE PILOT WHO SAYS HE HAS NEVER BEEN LOST is either pulling your leg or has never flown an airplane. Granted, everything is relative, including the term "lost." Maybe your definition of the word is like Daniel Boone's, who said, "Wal, I've never been lost, but I was misplaced once for three days."

Regardless of whether you like the term lost, misplaced or maybe disoriented, if you're holding on a beacon when your radio compass goes out, you need help. If on a cross-country you miss a checkpoint, cannot recognize the terrain and your radio equipment fails to pick up anything resembling a range or beacon, consider yourself lost (misplaced), (disoriented).

Add to these thoughts the possibility of encountering mechanical difficulties requiring an airfield right now, and you really establish the need for some fast navigational assistance.

The facility that has the primary function of assisting lost aircraft is the Direction Finding station. A single unit has the potential of giving bearings to or from the station. Two or more stations can establish the actual geographical position of an aircraft. The DF systems are reliable and can be depended upon provided you are within VHF or UHF range. A look at Figure 1 reveals the location of the DF stations included in the March Flight Service Center evaluation net.

It should be realized that the time may come when you need help but cannot raise a DF unit. In this case, the Air Defense radar network may be of assistance. These radar units have the primary responsibility of protecting our industrial plants and cities, but also possess the inherent capability of rendering assistance to lost or distressed aircraft. The procedure to be used in the event of radio failure when within range of a radar installation was covered in the article entitled "Hidden Help" in the November issue of FLYING SAFETY. The methods outlined in the following story for both DF and Radar Assistance are based on having operational radio receivers and transmitters.

It should be noted that utilizing the Air Defense system should be reserved for emergencies only, or in cases where, if assistance is not received, an emergency may subsequently become a reality. Conversely, utilizing the DF network for practice steers and fixes is strongly encouraged.

DELTA-FOXTROT

IT WAS a clear and cold March morning when the student pilot started rolling down the active runway. The T-Bird appeared to enjoy the chilled air for it leaped off after a minimum roll.

Climbing upstairs, on course, the pilot mentally reviewed each phase of his projected flight. This planning business was great stuff, but it surely did take up a lot of time. Passing through 5000 feet, he made the normal oxygen and fuel checks. Funny how easily habit is acquired.

He hit the first two check points right on the button. Computed airspeed was just right. Even now he was amazed at the accuracy of forecast winds. Those crystal-ball lads were really hot.

Sometime later the T-33 passed close to another check point, but the pilot missed it. He frowned, studied his map and looked at his watch. The bird-dog cranked around about 160 degrees and settled down. Then, without waiting longer, without considering a relative bearing, the student pilot tried to tune in the next station.

Possibly no one ever told this lad that ranges are often shut down for maintenance during VFR conditions. Maybe he didn't check the NOTAMS. There are several possibilities why he didn't know, but the fact remains the next range ahead was off the air.

Okay, you say, why didn't he fly a reciprocal from the last station? His course had been fairly good. Although he didn't see the last check point, the time element and bird-dog swing indicated station passage. Why fiddle around with a dead duck?

Of course you'd be right, but don't forget this laddie had a couple of hundred hours *total!* You've probably got more than that just taxiing. So he made his first mistake.

Remember how you got your wind up the first time you were lost? Sure, you were lucky and finally got oriented by flying down a railroad track and reading names of stations and water towers. Remember, too, you were flying an old BT-Vibrator and had lots of gas to mill around. But this lad had a T-Bird. Altitude meant fuel. Fuel and planning were his only hope. No hedge-hopping here.

In a few minutes the T-33 driver made his second mistake. After frantically trying to match up landmarks with existing hills and towns on the map, he concluded he had been blown way off course. Those weather jokers weren't so hot after all. Maybe if he held the map upside down it would help. But, no. That big mountain range up ahead still didn't fit anywhere on the chart.

Let's see. We were flying a heading of 240 degrees. Maybe a 180 would be the best bet. Seems as though there's a field back a ways. Let's see. The reciprocal of 240 must be ——'um, that would be 200 subtracted from 240 less 20. Sure, that's it. 20 degrees. Okay, we're lost. We might as well face it, but there should be enough fuel to get home.

Another few minutes sped by as the T-Bird boomed along over the desert wastes. A large dry wash slipped underneath. Some jagged black rocks thrust themselves from the desert floor like primeval monsters. Finally, a dusty road appeared, turning and twisting aimlessly. A rutted highway from nowhere to no place.

This was completely strange country. The pilot realized that something had gone wrong. Bad wrong. The totalizer was ticking off his last hope with monotonous, hesitating little skips. He could feel perspiration dripping from his armpits. The drops were cold as they soaked against his body. *Something* had to be done now!

He remembered vaguely that one of the instructors had talked about steers one day. Was it his instructor or somebody from the ground school? Funny how you can't tie things up right when you're excited. Well, who ever it was had said something about using the radio and calling for help on one of the channels. But, who to call? Doesn't seem very logical to call for help in the blind.

He studied the radio receiver panel for a bit, finally decided to take a gamble and punched the A button. He waited for the whistle of the channel change. It took but a moment. Then he wondered what to say.

He started the transmission timidly.

"Hello, this is Air Force jet 25012. If anyone can hear me, I'm lost."

He waited and listened. He could hear his own breathing and the harsh swishing of the ear phones. Nothing. Then the voice came. So suddenly that he jumped. It was a casual, friendly sort of voice.

"Air Force 25012. This is Yuma Radio; DF is standing by. Switch to Delta channel and call Yuma DF. If contact is not established in one minute, give Yuma Radio another call on this same frequency—over."

Well, this was more like it. The student could feel confidence bubbling through his system. He didn't feel lost now. Somebody was close by; somebody could help him.

He quickly changed channels and squeezed the mike button. "Yuma DF, this is Air Force jet 25012. Can you read me? This is an emergency. Which way should I fly to find a field? Over."

"Air Force 25012, this is Yuma DF Homer. Transmit for a steer—over."

The student pondered for a moment. He remembered something about a key that some radios had. There didn't seem to be anything like a key in the cockpit. Maybe if he talked into the mike the people at Yuma could find him. That's strange. Yuma must be a long ways off. Doesn't seem as though the wind could be that strong.

He started to count out loud, "One, two, three—" and on up to twenty. Then backwards to one again. He repeated this three times. Surely that would help the people on the ground.

He waited just a moment then heard the voice again.

"Air Force 25012, your inbound heading to Yuma with zero wind is 215 degrees, class 'Bravo'."

A moment later the station called again: "Air Force 25012, DF Evaluation has placed you approximately 90 nautical miles northeast of Phoenix. As you are low on fuel, DF net advises you are closer to Luke and suggests that you land there. Give Luke DF a call on Delta channel. They are reading you. Over."

This was peculiar gibberish! Somebody was mixed up. Luke field just couldn't be in that direction and what was this "Bravo" stuff. Still, he hadn't been doing very well on his own. In a few more minutes there wouldn't be any fuel. Let's give it a whirl anyway. He turned the T-Bird in a sweeping arc to a heading of 215 degrees.

He called Luke DF Homer and immediately received a response. At one minute intervals they requested he transmit a signal for a steer. They told him to hum into the mike rather than talk. Fifteen minutes later he was over the base. The engine flamed out just as he touched down.

This student was lucky, you say? There is no question about it, but his experience is duplicated many times a month, and it isn't always the new boys who get lost. Here are a few quick examples. They are true.

- A T-28 on a flight from Williams to Edwards became "temporarily uncertain of his position." The aircraft was worked by George and Edwards DF units to a position over George AFB. The pilot stated that he would continue to Edwards at which time Edwards DF took over and monitored his flight into Edwards AFB.
- A B-26 on a DVFR flight from Colorado Springs to Long Beach became lost. He was picked up by Williams DF and his position was fixed through steers from Williams and Davis-Monthan DF sites. The aircraft was brought to a safe landing at Williams AFB.
- A C-45 on a VFR flight from Big Springs, Texas, to Davis-Monthan AFB was reported lost by Tucson approach control. His last known position was over El Paso, Texas. DF evaluation net notified all DF sites along his route of flight. The pilot was contacted by Davis-Monthan DF and directed to Davis-Monthan safely.
- An Air Fore jet was on a VFR flight from Luke AFB to Lowry AFB via Loma Radio, which is northwest of the Albuquerque ADIZ. The aircraft had an hour and forty-five minutes ETE and three hours of fuel. Approximately two hours and fifteen minutes after departure, the aircraft was reported lost and low on fuel by Clovis tower. The DF net alerted Clovis and Webb DF sites. Shortly thereafter, fixes established by the two DF units placed the pilot 30 miles northeast of Clovis. The pilot was vectored into Clovis and landed without incident. Point of initial pickup by DF was more than 300 nautical miles off his filed route of flight.
- Recently the operations officer on duty at March DF Evaluation Center was notified by the Yuma DF site that a Navy aircraft, a TBM flying in formation with an F4U, was requesting an emergency steer. The Navy pilot thought he was north of Yuma County Airport. At that time, he was given an inbound steer of 357 degrees, class Bravo. All other DF sites in the area were alerted, but they reported no contact. The weather at the time was VFR. The information was plotted on the DF board, and the reciprocal of 357 degrees from Yuma extended south into Mexico over a large body of water. The pilot at this time stated that he was over a large body of water. The March DF evaluation net relayed to him a probable position of 55 miles south of Yuma County Airport over the Rio Hardy, in Mexico. El Centro Naval Air Station DF site was also able to give a bearing to the evaluation net and, as a result, the pilot was advised that he was approximately 22 miles south-southwest of Yuma County Airport. The aircraft landed at Yuma with no further incident.

The foregoing are just a few "saves" selected at random from the files of the March DF Evaluation Center. Interestingly enough, DF stations

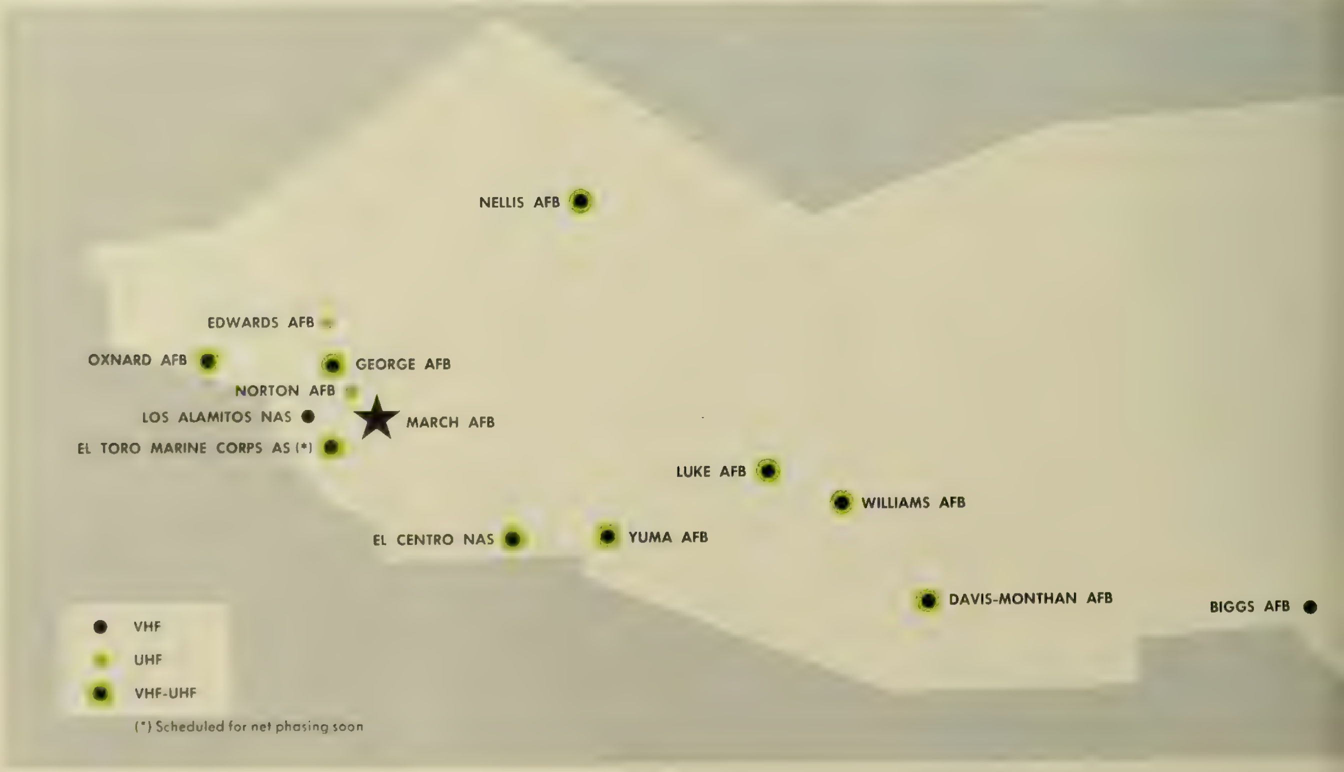


Figure 1. March DF Evaluation Center area of responsibility. Seven such areas exist in the continental U.S.

throughout the country find that the CAVU days are the busiest. This, of course, means just one thing. Pilots tend to get lax when the sky is blue and visibility is unlimited. Here's an example of a jet jockey who flew past his ETA and failed to request a DF.

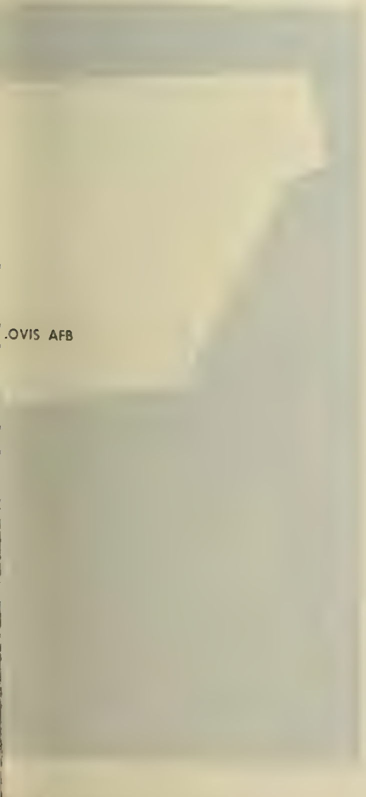
The Air Force jet departed from a base in northern California. His flight plan was filed as DVFR direct to a base in the Phoenix area. There wasn't a cloud in the sky.

When the aircraft became low on fuel, the pilot located a hard-surfaced strip and set the aircraft down. He felt rather ill at ease when the alert crew that met the plane turned out to be an individual driving a donkey who greeted him with, "Buenas Dias, Señor." You've probably guessed it. The pilot had overflown his destination and landed deep in Mexico.

Although Directional Finding service has been with us for quite a number of years, it has only been of late that a coordinating system has been established. If you are like most of us, you probably wonder how the whole thing works.

The DF net is made up of all UHF-VHF/DF stations operated by the USAF and many U. S. Navy sites. Within the continental United States there are seven separate nets, each with a Military Flight Service Center acting as the DF net control and evaluation center for its respective area of responsibility.

The DF operator gives a steer to the lost pilot and advises the evaluation net controller.



DF nets and DF Evaluation Centers are utilized primarily for lost aircraft as well as emergency and distress operations. The service may be utilized for practice fixing operations to familiarize pilots with the systems employed. However, such practice with an entire net is limited to hours when circuits are not busy. Individual DF stations will work practice runs at any time. When the chips are down, of course, the entire net is immediately available for any distressed aircraft.

In general, all emergency operations should be conducted on "D" channel (121.50 Mcs) for Air Force aircraft equipped with eight channel VHF communications sets, "C" channel, (137.88 Mcs) for the four channel VHF sets and channel "1" (243.00 Mcs) for airplanes equipped with only UHF sets.

Should an aircraft, in an emergency, contact an approach control or any other facility on a frequency other than 121.50 Mcs or 243.00 Mcs, the pilot normally will be instructed to use the same frequency with which the original contact was established for DF purposes. This procedure is recommended because aircraft in emergencies have lost communications with all ground agencies after being instructed to change frequencies. It should be noted, however, that unless an emergency is declared by the pilot, he will be instructed to change to the regular DF frequency.

Advisories to the net control MFSC and the primary coordinating agency under both IFR and VFR conditions for lost aircraft, aircraft safety, emergency and distressed operations, consist of the following:

- Aircraft number and type.
- Frequency being utilized.
- Course being flown, altitude and indicated airspeed.
- Nature of the emergency.

- Remaining fuel in flying time.
- Other operating frequencies available in the aircraft.
- Whether aircraft is IFR or VFR at the time of the emergency.

The DF operator working the aircraft advises net control MFSC and the primary coordinating agency or Air Route Traffic Control at the respective station, immediately after the first course is given to the aircraft. The primary coordinating unit or ARTC facility in turn alerts all necessary agencies and facilities at the station. From this point on, many people in the various activities begin to take a personal interest in the distressed aircraft.

The DF operator classifies all courses and fixes to the distressed aircraft. When you utilize the DF service, the following classifications should be known:

Bearings

Class *A* ± 2 degrees
Class *B* ± 5 degrees
Class *C* ± 10 degrees

Fixes

(two or more sites)

Class *A* — Within 5 miles
Class *B* — Within 20 miles
Class *C* — Within 50 miles

In addition to plotting your position through the DF Evaluation Center, Flight Service Centers also offer an advisory service. Many pilots do not realize the potential benefits that are available from such service. Rapidly lowering ceilings at the destination, en route thunderstorms, status of alternates and other pertinent information may be passed on to the pilot by the DF operator.

Advisories to the pilot from Flight Service are of an informative nature and are not directive upon the pilot. (You're still flying the airplane.)

In a controlled area, should the pilot desire to change his flight plan or deviate from his present heading as a result of an advisory from Flight Service, an ARTC clearance must first be obtained. The Flight Service Center will obtain the new clearance prior to clearing the pilot to effect the desired change.

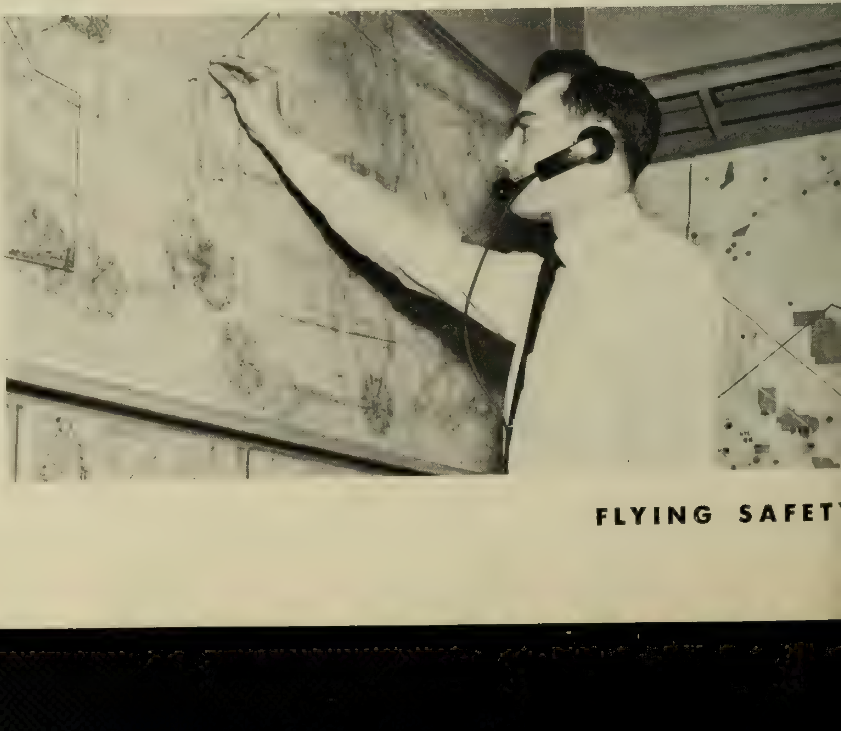
Under VFR conditions or IFR outside of controlled areas, the system works just a bit differently. If a pilot elects to alter his proposed flight plan as a result of an advisory, the DF operator will advise the Flight Service Center of any flight path change taken by the pilot. The DF operator also will advise the control tower at his station of the change in course or the pilot's intentions. Flight Service will advise the pilot, through DF, of the proper heading for his newly elected destination and will insure that the pilot is advised of current weather conditions along his newly chosen route. (Don't forget to reset your gyro compass!)

The DF operator working the aircraft gives the first course to the aircraft prior to alerting MFSC net control. The DF operator then continues to give courses every minute for jet and fighter type aircraft, and every two minutes for reciprocating type aircraft. These steers are continued until the plane is over the station, at which time the appropriate control facility takes over.

The DF station that makes the original contact with the aircraft and gives the first steer to the pilot continues to be the only station to transmit to the aircraft under normal conditions. Exceptions can be made when the original contacting DF station is experiencing difficulty working the

Flight Service personnel are ready to give assistance to aircraft in emergency situations.

A plotter can establish geographical positions of aircraft through two or more DF bearings



aircraft and another DF station could establish better communications. The MFSC net control is responsible in such instances for effecting and directing the change in stations.

Flight Service alerts the necessary DF stations for fixing operations upon alert from the original contacting station.

If the original contact is with a DF station, the other alerted DF stations will not transmit to the aircraft. If the original contact is with another type facility, i.e., control tower or approach control, and DF assistance is requested but is not available at that respective station, DF evaluation is alerted by the respective contacting facility. DF evaluation in turn alerts the appropriate DF stations and advises the original contacting facility to have the pilot initiate a call to any one designated DF station. If and when contact is established by any one DF station, the MFSC net control designates that DF unit as the transmitting station. Requests for re-transmission for homing come from the transmitting station only.

When a DF operator hears an emergency call, but is unable to make contact with the aircraft concerned, he makes every effort to obtain a course and alerts MFSC net control, advising them of the full particulars. If a course cannot be obtained, the net control is still alerted and full particulars are given. The MFSC in turn alerts ARTC and makes every effort to have other stations in the vicinity contact the aircraft.

Where a course has been rendered to net control under such conditions, ARTC is notified and every effort is made to have other DF sites on or near the course listen in an attempt to establish secondary steers for relay to the net. The DF operator also advises the primary AACS coordinating facility at his respective station of this traffic.

Advisories to the pilot regarding other AACS facilities at the station where the DF unit rendering the courses is located comes from the DF operator. Advisories regarding emergency altitudes, terrain features and local weather conditions come from the DF operator as a voluntary measure without awaiting a query from the pilot.

From this description of DF service we hope that you'll remember some of the more important phases. If you ever need help, there's aid as close as your microphone. ●

GOLF-COCA-INDIA

RENDERING assistance to lost aircraft is the job of the DF station. It works fine and is used daily to assist aircraft.

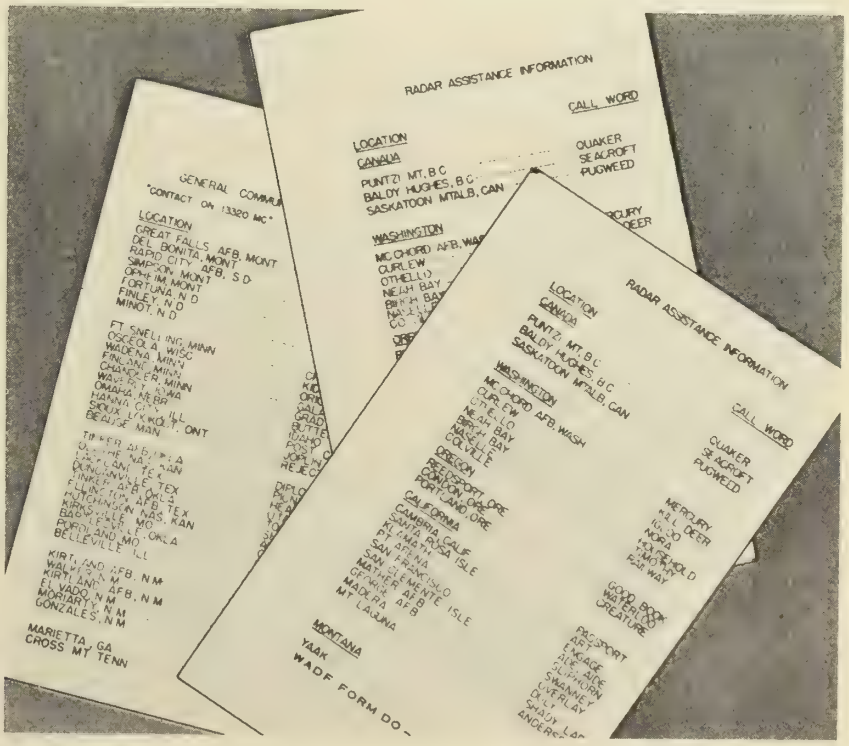
Now, here is a story about the DF station's big brother, the Air Defense radar network. It should be kept in mind that the vast radar surveillance system was not established to assist aircraft. It has the primary responsibility of detecting unknown aircraft and vectoring interceptors for identification purposes. However, ADC radar installations are responsible for insuring continuous monitoring of emergency frequencies and responding to any call from an aircraft in distress or requiring emergency navigational assistance. Among other things, they also may be utilized to provide general storm advisory information with suggested flight paths to avoid intense storm areas.

Utilizing the ADC's radar facilities for navigational assistance is particularly attractive to aircraft equipped with UHF. The UHF/DF net is expanding rapidly; however, there are still many areas where it is not possible to receive such aid. Thus GCI assistance comes in mighty handy.

It is possible that your request for radar assistance may be answered by the one word "UNABLE!" This means that for some reason the service cannot be furnished. Under these conditions it may be possible to contact another site and receive help.

Many flying organizations have prepared maps or cards pinpointing the GCI sites throughout the country by call sign and location. They are prepared in pocket size, yet are large enough to be readable. A blow-up of such a map is illustrated on page 11.

One very good point to remember whenever or wherever you fly concerns your IFF equipment. If you have this equipment installed, place it in the stand-by position just prior



Many flying organizations have prepared cards pinpointing GCI sites throughout the country.

RADAR ASSISTANCE INFORMATION

LOCATION
CANADA
PUNTZI MT, B C
BALDY HUGHES, B C
SASKATOON MTALB, CAN
WASHINGTON
MC CHORD AFB, WASH
CURLEW
OTHELLO
NEAH BAY
BIRCH BAY
NASELLE
COLVILLE
OREGON
REEDSPORT, ORE
CONDON, ORE
PORTLAND, ORE
CALIFORNIA
CAMBRIA, CALIF
SANTA ROSA ISLE
KLAMATH
PT ARENA
SAN FRANCISCO
SAN CLEMENTE ISLE
MATHER AFB
GEORGE AFB
MADERA
MT LAGUNA
MONTANA
YAAK
WADF FORM DO

CALL WORD
QUAKER
SEACROFT
PUGWEED
MERCURY
KILL DEER
IGLOO
NORA
HOUSEHOLD
TIMOTHY
RAILWAY
GOOD BOOK
WATERLOO
CREATURE
PASSPORT
ART
ENGAGE
AIDE AIDE
SLIPHORN
SWANNEY
OVERLAY
DULY
SHADY LA
ANDERS

GENERAL COMMU
"CONTACT ON 13320 MC"
LOCATION
GREAT FALLS AFB, MONT
DEL BONITA, MONT
RAPID CITY AFB, S D
SIMPSON, MONT
OPHEIM, MONT
FORTUNA, N D
FINLEY, N D
MINOT, N D
FT SNELLING, MINN
OSCEOLA, WISC
WADENA, MINN
FINLAND, MINN
CHANDLER, MINN
WAVERLY, IOWA
OMAHA, NEBR
HANNA CITY, ILL
SIOUX LOOKOUT, ONT
BEAUSE MAN
KIRTLAND AFB, N M
WALKER, N M
KIRTLAND AFB, N M
EL VADO, N M
MORIARTY, N M
GONZALES, N M
MARIETTA, GA
CROSS MT TENN

to take-off. In this position the set will warm up and be ready. If the GCI controller requests a certain setting for identification purposes you can give it to him without any delay. What is even more important is that in an emergency you merely flip the IFF to that position and you transmit the signal *right now;* then things really start popping to get you some help.

An example of the system's capabilities recently involved a lost B-29. After three hours of flight on a round-robin, the pilot was not able to pick up his next checkpoint. After trying to locate a radio facility for homing purposes the pilot called in the blind. He was answered by a CAA communications facility and directed to contact "Hubert" on the emergency channel. After contact it became evident to the director that the aircraft's magnetic compass was inoperative. The aircraft's track and the radar indications differed by some 60 degrees from the vectors given. By specifying the amounts of turn to either right or left, the director was able to control the B-29 to an area where he could orient himself and make a successful letdown and landing.

Each radar installation has a video presentation of all airfields of 5000 feet or more within its area. In the event of an emergency necessitating an immediate landing, the director can assist in vectoring the aircraft to a suitable landing area.

There are numerous cases on the books where aircraft have received advisories that have guided them around severe storms. If radar advisory service is desired, the pilot of an aircraft will request such service through the appropriate Air Route Traffic Control Center, using normal en route communications facilities. ARTC will relay the request to the appropriate radar station. Upon receiving the concurrence of the director, the aircraft will be cleared by ARTC to establish radio contact with a radar facility for advisory information. ARTC will advise the aircraft to change to the appropriate frequency and to stand by for a call. When the aircraft is properly identified, the director will furnish the pilot with the information requested. The pilot then advises ARTC of any changes in his filed IFR flight plan.

If contact with the radar facility is not made, or upon receipt of the word "UNABLE," the pilot will return to the appropriate ARTC frequency and so advise.

Under radar advisory control, aircraft position information, and the direction and distance from easily recognized reference points will be forwarded by the radar facility to the appropriate Air Route Traffic Control Center when a vector is started, when it is completed or when requested by ARTC. This will facilitate correlation of the aircraft's position, and permit ARTC separation.

There is an additional feature of the radar network known as flight following. For example, an F-86 started out on an extended IFR cross-country flight. After 20 minutes of flight he noticed that his external fuel tanks had failed to feed. A fast calculation revealed that he could not reach his destination, so he immediately contacted the closest airfield. He was informed that the field was IFR. still he requested and received letdown instructions.

Prior to starting his descent, the tanks started functioning again. He advised the airfield that he intended to continue to his destination, then contacted "Top Coat," the closest GCI site. He advised them of his previous external tank difficulties and, since the weather in the immediate area was bad, that he had decided to continue to his destination. He requested flight following just in case the tanks gave him trouble again, necessitating a landing, en route.

He was kept under surveillance by "Top Coat" and called them periodically to confirm his position. "Top Coat" passed him on to the next radar installation along the route and so on, until he reached his destination. He let down VFR through a break in the cloud cover and completed his landing. Only one thing was wrong. After landing he was greeted with a flying violation. During the entire flight, nobody bothered to inform ARTC as to the aircraft's position and altitude. ARTC had this aircraft listed as missing. Flight following is not a routine service. It does not relieve the pilot of his responsibility to navigate. Except in an emergency a pilot being flight followed is responsible for guarding an en route frequency and making position reports.

In order to utilize the facilities available through the Air Defense Command's radar installations, it is important to remember a few basic responsibilities:

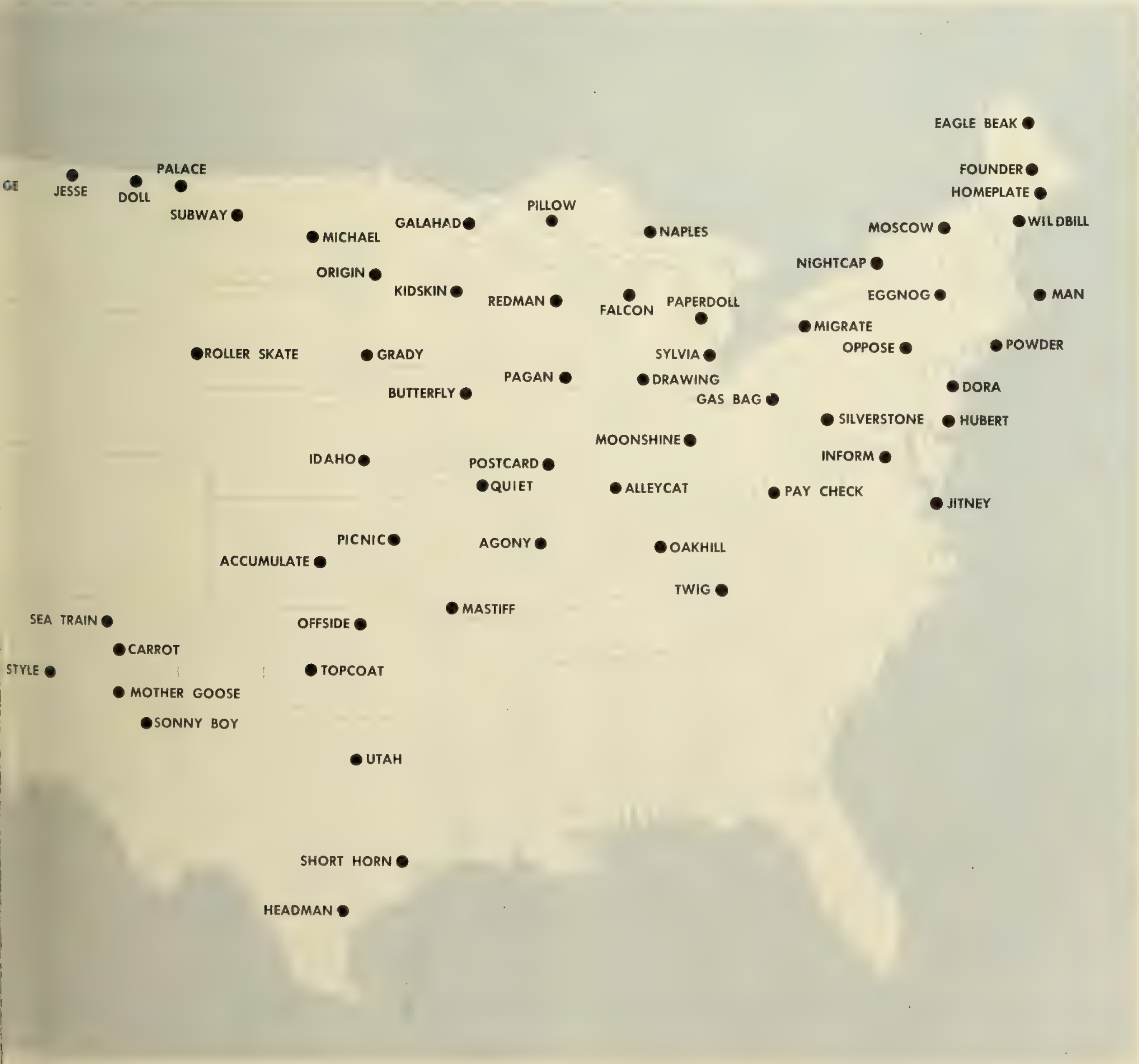
- There have been cases where pilots, who were not in any difficulty, jammed the frequencies so much that interception operations of unidentified aircraft has been hampered. Also, pilots who have successfully utilized the GCI flight following plan previously, have become lackadaisical in their flight planning. They have assumed the attitude that maps and charts are just so much excess baggage when there is a system available that can direct them to any airfield on the continent. The hazards associated with such an attitude are obvious. It is entirely probable that the

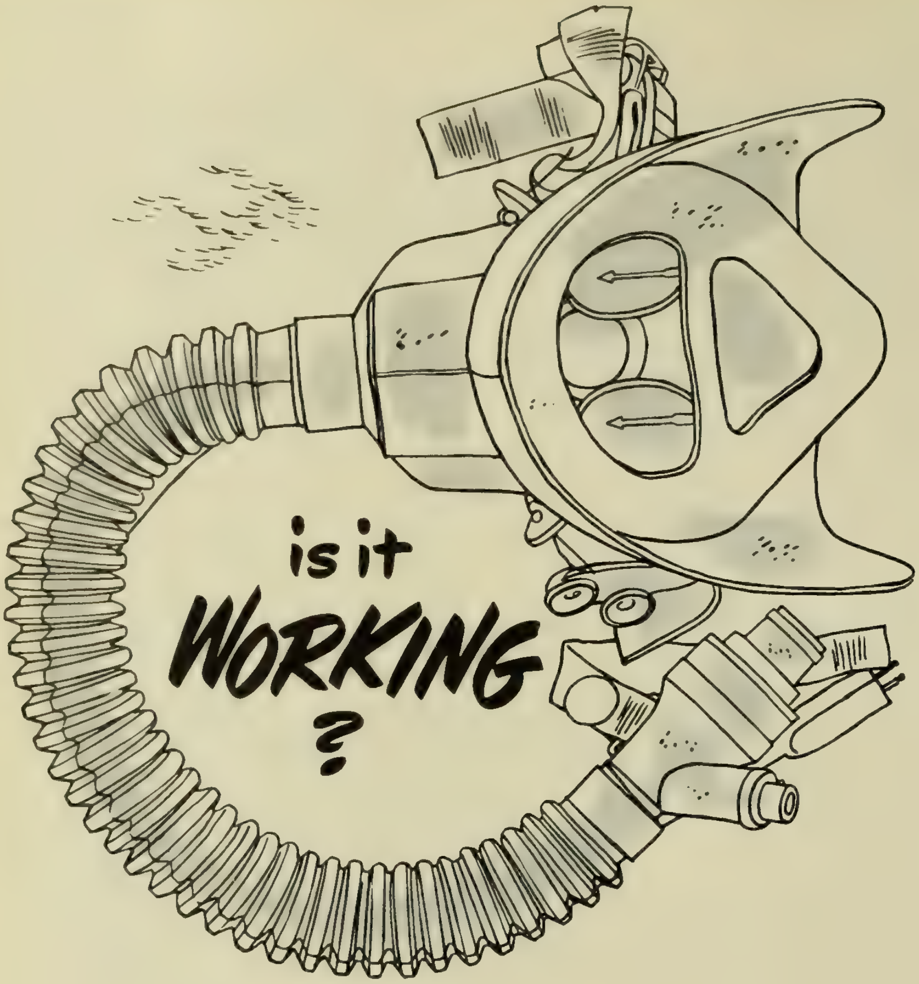
radar unit may not be able to work you or maybe your UHF or VHF radio equipment becomes inoperative. Then without maps and charts you're in real trouble.

- The responsibility for separation of aircraft within controlled airspace remains with the Civil Aeronautics Administration. The pilot should assure himself that the appropriate ARTC Communications Center is notified in accordance with existing regulations. ADC assumes no responsibility for the provisions of separation between aircraft. The pilot will retain the reponsibility for any operation which may be conducted out of controlled airspace.
- The primary mission of the Air Defense Command is the air defense of the Continental United States. In the program of USAF Radar Advisory Service, no liability will be incurred by the Air Force nor will the primary mission of the Air Defense Command be compromised.
- In all cases any information given is advisory in nature and the responsibility for the operation of the aircraft rests with the pilot.
- When calling for assistance give the GCI director your position (if possible), aircraft type, altitude, heading, departure point and destination.

One last thing, DF has the major responsibility for rendering assistance to aircraft; try it first if you happen to become lost (misplaced), (disoriented). ●

This map shows the location and call sign of GCI sites that can be used by pilots in an emergency.





is it WORKING?

Brigadier General A. H. Schwichtenberg, Surgeon, ADC

A PILOT WAS leading his flight back from a mission which involved flying at 30,000 feet. This altitude had been flown for approximately one-half hour. When told to return home, the pilot stated he felt very gay, seemed to be flying into a haze and that the visibility was decreasing. He checked his oxygen regulator and found the blinker working.

He made a routine descent, flew a good traffic pattern and turned onto final. After lining up with the runway, he allowed the airspeed to drop off excessively, stalled out and landed short, destroying the aircraft.

His first words upon being pulled from the plane were, "I feel woozy. I must have hypoxia."

He later stated that the last thing he remembered was deciding to let down fast; the last part of the mission was a total blank.

He was wearing a borrowed helmet and oxygen mask, both too large for him. A leak was found between the mask and the bridge of the pilot's nose.

Today, an airman must be sure his equipment will stand the test and that each and every part will work when he needs it, whether his mission involves potential battle or training. Sometimes our airmen overlook seemingly small, unimportant items like dust in their masks. They don't understand fully how to care for and use all of their equipment and they fail to visualize situations where they must depend on the perfect functioning of this equipment.

Recently this office, in conjunction with Air Defense Command's Office of Flight Safety, initiated a project to check the reactions of pilots unknowingly subjected to unpressurized flight at 30,000 feet. It was believed that with the present pressurized cockpits, pilots could easily become complacent about their oxygen equipment. However, in case failure or malfunction of the pressurization equipment occurred, and a pilot was wearing poorly maintained or improperly fitted oxygen equipment, hypoxia could occur and probably would result in a serious accident. In short, it was considered that many of our pilots had come to depend upon their pressurization rather than their oxygen equipment to carry them at whatever altitude they were flying. Perhaps another instance of the idea that "it couldn't happen to me." But, unfortunately it does.

Two pilots, Capt. William Gray and Capt. William Savidge, from the Office of Flight Safety, ADC, were assigned as project officers. They made a tour of eight ADC bases, ostensibly to conduct spot instrument checks throughout the command. They flew with a total of 29 pilots during the survey. The experience level of this group ranged from 400 hours to 750 hours total time, and from 150 to 500 hours jet time.

All flights were flown in unpressurized cockpits, with the students in the rear seat. None of the pilots being checked were informed that the flight would be conducted under unpressurized conditions although the squadron commanders had been fully briefed and were completely in accord with the test.

Prior to starting the survey, the two check pilots went through the altitude indoctrination chamber at Lowry AFB to check the performance of the oxygen equipment to be used during the tests. In addition, they removed their masks at 25,000 feet to be sure of their own individual reactions to hypoxia and were given additional instruction in order to help them recognize it in others.

The pilots being tested were told to make instrument takeoffs, climbing turns, work an aural null problem, perform ADF tracking, steep turns, an ADF penetration and a GCA run. The pressurization dump valve was intentionally opened by the IP prior to engine start.

Each flight remained at 30,000 feet for at least 30 minutes, which was considered to be sufficient time for any hypoxic symptoms to develop. Each pilot was instructed to advise the IP of his procedures as he performed each maneuver. This was used as a check on the mental condition of the pilot to determine if hypoxia was occurring.

Of the 29 pilots tested, two developed severe cases of hypoxia and one experienced mild hypoxic symptoms. This represented slightly more than 10 per cent of all the pilots tested. When the tests were first proposed we had expected perhaps one case with mild symptoms but had not anticipated that the percentage would run so high.

As is usual in hypoxia, each case in which a pilot had trouble varied from the others. In one, the pilot proceeded with his mission as briefed and was performing climbing turns through 24,000 feet when he complained of feeling dizzy. His airspeed control became erratic and he was instructed to maintain 215 knots, but he was unable to follow instructions.

He was then told to turn to a specific heading, but again was unable to do so and failed to roll out of the turn. Upon being asked why he failed to follow instructions he replied, "I can't remember what you told me."

At this point he also complained of dizziness and a tingling over his entire body. The IP took over the aircraft, instructed the pilot to place his oxygen control on SAFETY and descended to a lower altitude.

The student placed his regulator in the desired position, the *only* instructions he had followed since the onset of hypoxia, and recovered normally. No evidence of mask or system malfunction was discovered in a subsequent investigation. However, it is believed likely that the pressure of the oxygen on the SAFETY position caused stuck valves to release. At no time did this pilot recognize the sensations of dizziness and tingling as two indications of approaching hypoxia.

In the second case, the pilot performed his instrument takeoff and climbing turns satisfactorily, but five minutes after leveling off at 30,000 feet his airspeed control began to fall off. Then the aircraft started into a steep left turn and dive. The IP recovered from this maneuver and asked the pilot what he was doing. There was no response to this question; however, when asked how he felt, the student pilot replied that he felt fine.

Next he was told to make a 90-degree turn. When there was no reaction to this instruction, the IP took control of the aircraft, told the pilot to turn to SAFETY position on the regulator and descended rapidly. The student recovered at the lower altitude but professed no knowledge of what had taken place after leveling off at 30,000 feet. He stated that his first recollections were that the aircraft was in a steep dive and that the instrument panel was coming back into focus. This pilot received none of the warning symptoms more commonly associated with hypoxia. A of observing *all* of your equipment, and how important it is to know what to do if a malfunction occurs. It is possible and even probable that many undetermined accidents have been caused by hypoxia brought on by malfunctioning oxygen equipment in depressurized aircraft.

Some of our conclusions and recommendations derived from these tests include:

- It is considered highly probable that we are having more trouble with our masks than many pilots realize. This particularly may involve the exhalation valve (the lower one in the mask). Many pilots have noted that they must forcibly exhale in order to free the valve when first putting on the mask. It is clear now that even small amounts of dirt or mucous may dry on this valve and cause it to stick open or closed. More common and — also more difficult to discern is an intermittent malfunction such as when the valve sticks open part of the time. A simple test which will subsequent check of his mask revealed minute particles of dirt in the valves, particularly the exhalation valves, although the mask had been cleaned and checked one week prior to the flight by individuals in the personal equipment section.

The third pilot experienced hypoxia after being at altitude for approximately 15 minutes. He was performing a steep turn when he complained of a tingling sensation in his arms and legs. The IP told him to place the regulator on SAFETY and the symptoms disappeared. No malfunction of his equipment was discovered though again this may have been a case of stuck valves releasing.

In addition to these cases, one of the check pilots experienced slight hypoxia during one ride. His mask had been cleaned two days before, but small particles of dirt were found in the mask valves, again most frequently in the exhalation valve.

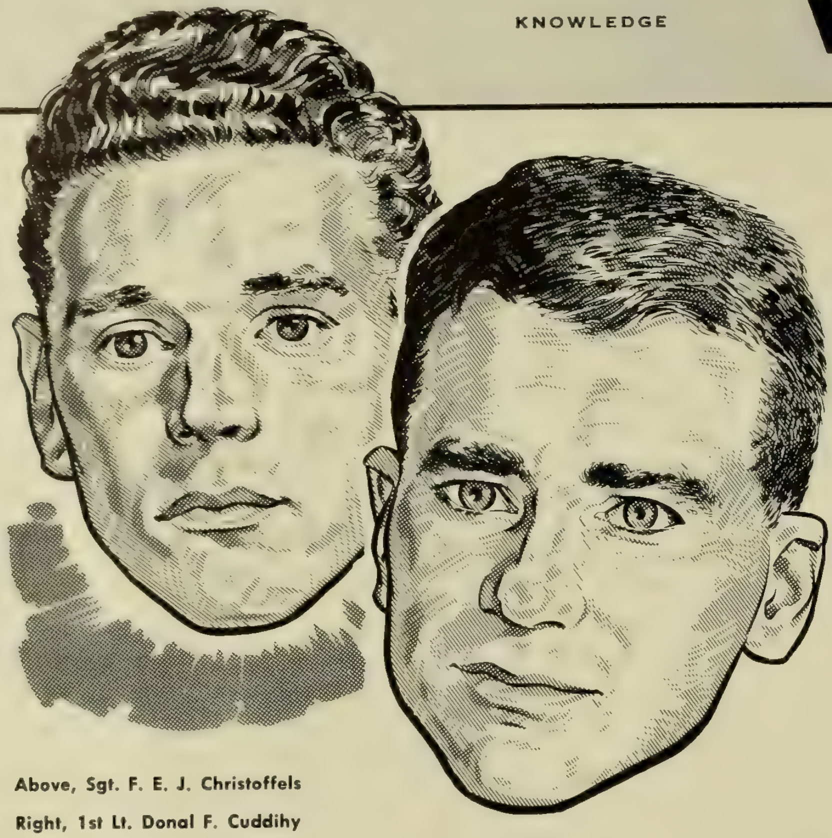
A few of the pilots tested complained of the cold and asked for a check of the pressurization system. Each time they were informed that everything was normal in the front cockpit. Significantly, most of them failed to turn their regulators to 100 per cent, nor did they turn the dial to give themselves pressure oxygen.

These tests emphasize the necessity often reveal this condition is to place the thumb over the end of the oxygen hose and breathe in and out lightly. If the valve is sticking open it will permit one to inhale and exhale lightly though deep breathing will cause it to open and close normally. Such a valve should be replaced. It is worth knowing too, that when the exhalation valve sticks open and one becomes hypoxic and the respiration becomes deeper, just enough negative pressure can be created in the system to cause the blinker to snap open and closed for an instant. When one is dull mentally this is misinterpreted as normal operation. These are the tremendous trifles upon which your life may well depend.

- Intermittent failure of regulating systems may disrupt the flow of oxygen.
- Standard oxygen test equipment should be used by all units. During this experiment it was noted that some squadrons used a bellows tester, others a complete oxygen system as a tester and one unit had *no* test equipment. (With a good pressure demand oxygen mask, a bellows tester will show a no-leak fit when the mask is held in one's hand!)
- Many pilots are not properly aware of hypoxia symptoms and need more training in how to care for their personal oxygen equipment. They need to be more fully impressed with this danger and that it is as serious as fuel shortage.
- Most units have sufficient masks, but size distribution sometimes doesn't allow proper fitting. Consequently, many pilots are forced to use an incorrect size mask. Commanders should check this constantly.
- A requirement exists for intensive training of personal equipment specialists in the care, cleaning and fitting of masks. Masks should be protected from dirt and other foreign matter by a dust-proof cover at all times when not in use.
- Periodic unpressurized flights should be made with two pilots aboard. This will serve to force careful inspection and maintenance of personal oxygen equipment. When this is done, at least one pilot must be certain of his oxygen equipment functioning.
- The point of this article is, if you're a pilot who flies high-altitude pressurized aircraft and must use oxygen equipment, remember that those "small" things are as important as fuel in the aircraft. The oxygen system must function properly or the means of burning the human fuel is eliminated and what might be termed a pilot flameout, occurs. ●

KNOWLEDGE

WELL



Above, Sgt. F. E. J. Christoffels

Right, 1st Lt. Donal F. Cuddihy

1st Lieutenant
Donal F. Cuddihy

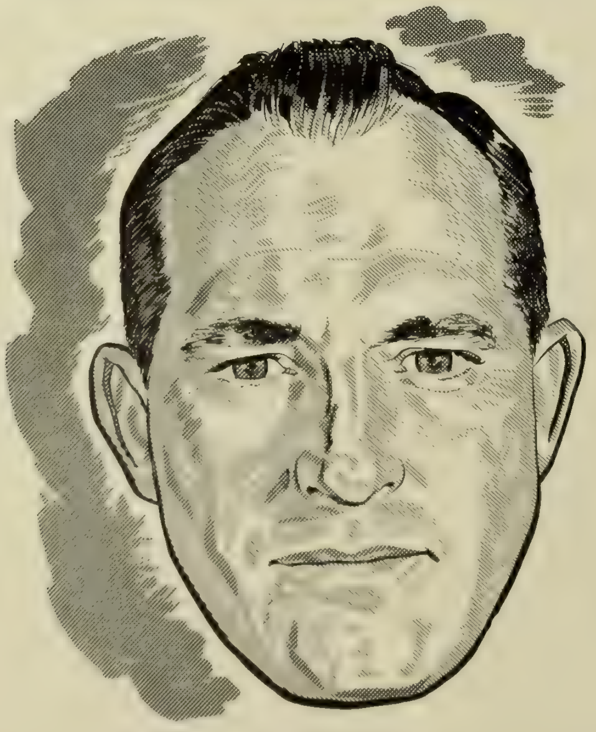
★

Sgt. F. E. J.
Christoffels

Netherlands — MDAP Student

★

3604th Flying Training Sqd
Luke AFB, Arizona



Capt. Donald H. Swan

1738th Ferrying Sqdn., Long Beach Airport

Capt. Swan and his wingman took off on a flight from Edmonton Airport to Ft. Nelson under instrument conditions. Shortly after takeoff, while flying intermittently through an overcast at 25,000 feet, the wingman reported that his T-33's hydraulic pressure was fluctuating but that everything seemed to be functioning normally.

After contacting Ft. Nelson, the flight received approval for a straight-in IFR letdown. About six minutes out, at 13,000 feet, the wingman called again stating that he was in severe difficulties. He had lost sight of the lead ship and was unable to control the aircraft.

Capt. Swan decided that the hydraulic system had

DONE

TRAINING

Sergeant Christoffels, MDAP student from the Royal Netherlands Air Force, and his IP, 1st Lt. Cuddihy, were participating in Sgt. Christoffels' initial checkout in the F-84. During a gear down, flaps down, stall series, Sgt. Christoffels experienced an engine explosion and subsequent power loss.

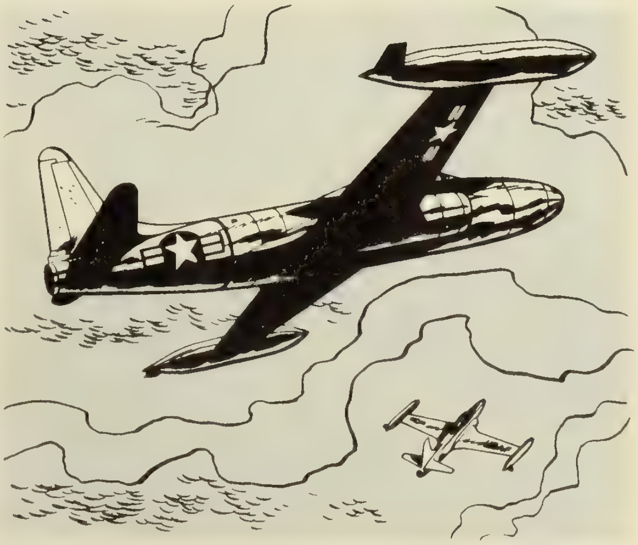
Lt. Cuddihy, flying wing on the student's aircraft, then advised Sgt. Christoffels to set up a flameout pattern for a Luke auxiliary field. Their position was 25 miles north of the field at an altitude of 15,000 feet. Through constant instructions during the actual flameout, Lt. Cuddihy directed the MDAP student to the landing end of the runway.

Due to his decisive action and complete knowledge of emergency procedures, Lt. Cuddihy talked his student through the emergency pattern to a landing. Sgt. Christoffels, on his first ride in a jet fighter plane, was confronted with a serious emergency situation, but through his calmness and swift execution of instructions he landed his aircraft satisfactorily. Their actions reflect credit to themselves and their respective services. Well Done!

failed and that the flight control boost was out. He immediately advised the pilot to go on instruments, and repeated his instructions several times for emphasis. Suddenly the wingman called that he had the lead ship in sight and was coming down in a dive off his right wing. Capt. Swan spotted the plane and peeled off after it. He attempted to talk the pilot into reorienting himself by stressing the need of recovery to normal flight. The wingman responded by pulling up into a steep, right turn and again was advised of the aircraft's attitude. His instructions had a steadying effect and he was able to talk the pilot into what was actually a recovery from a vertical position.

The wingman, who was suffering badly from vertigo, regained control of his aircraft and returned to a straight and level attitude on the lead plane's wing. The flight resumed the letdown and made a normal landing.

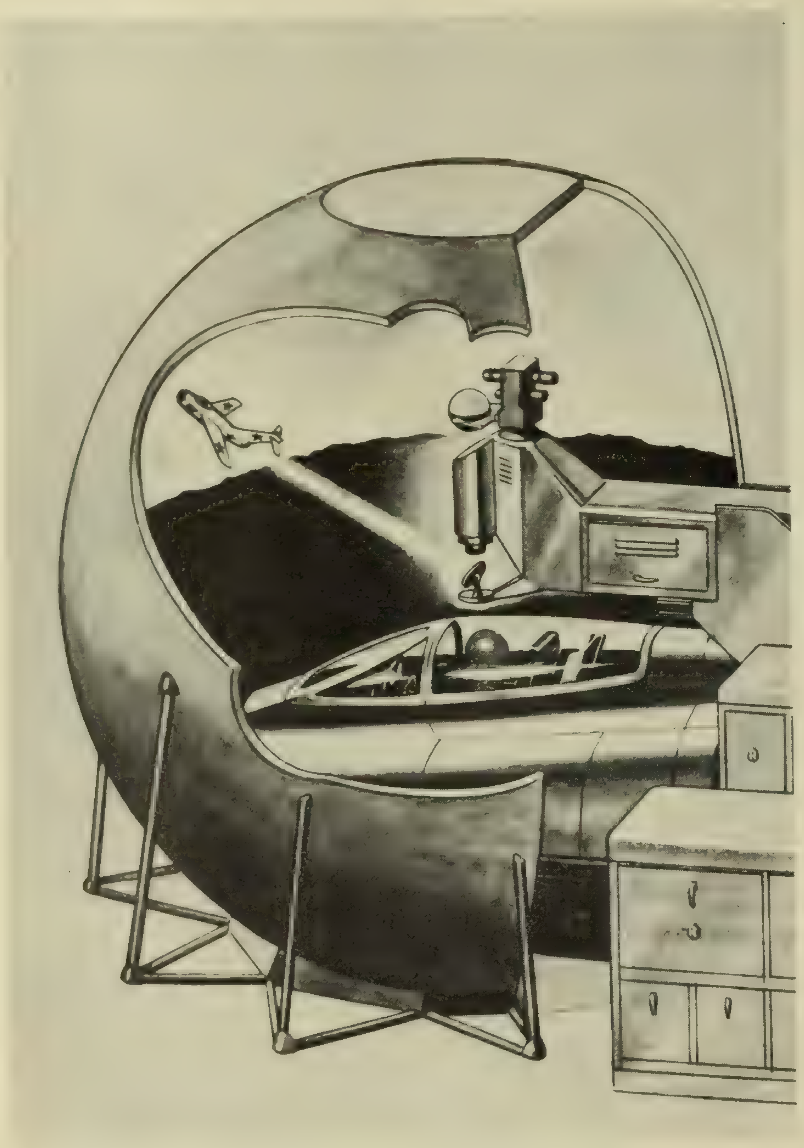
The skill and excellent judgment displayed by Capt. Swan during this emergency are a credit to him and to the U. S. Air Force. Well Done!



VOL. 11, No. 3

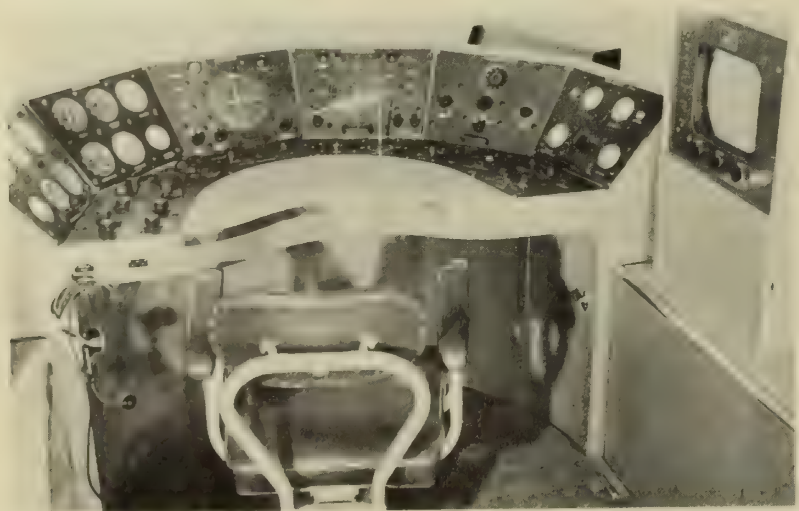
TIGER

Roy H. Gardner, Equipment Laboratory,
Wright Air Development Center



The F-151 is designed to teach the basic gunnery skills and approach and positioning tactics.

The instructor's console is equipped with scoring devices used to evaluate the student pilots.



FLEDGLING fighter pilots who return from their first mission on the gunnery range are usually hopelessly disillusioned individuals. Instead of hitting the target a reasonable number of times, many discover they cannot so much as find the sight reticle. This experience can be so unnerving that a good many of these junior Tigers are just thankful to return to the ground, regardless of their gunnery score.

From such an inauspicious beginning came the aces of Korea and World War II, but in between were long periods of arduous and oftentimes discouraging training. Those who showed promise in this training period received their post-graduate course in combat itself, but to become aces they had to become so indoctrinated in the operation of their equipment that their actions were automatic. A brief mental lapse or a pause of a second or two to think out a situation often led to somewhat unpleasant results.

A requirement has long existed for a device that would provide instructions to fighter pilots in the complete operating technique of their aircraft armament system. A trainer of this type has, as its justification, ability to overcome some of the difficulties encountered in teaching fixed gunnery skills when the instructor can only monitor the student's performance from a distance. After three years of research and development, Wright Air Development Center believes that it has the answer to this requirement in the form of the F-151 Fixed Gunnery Trainer.

No longer must the frustrated,

TRAINER

This indicator enables the instructor to position a target in relation to the student's simulator.

long-suffering student pilot go through life wondering how all those bullets went through that rag without leaving a hole. This gadget can give him the answers.

The design of the trainer is based upon the principle that pilots must be taught those gunnery skills necessary for successful completion of various combat missions with fighter aircraft. Secondary considerations include the training in procedures and skills which will increase the likelihood that such missions will be achieved with a minimum of cost in terms of men and material.

With this combination gunnery trainer and flight simulator, a pilot is able to run through his preflight check, engine start, takeoff, target interception and return to base without leaving the ground.

Basically the F-151 Fixed Gunnery Trainer consists of an aircraft flight simulator which represents the attacking fighter, a suitable projection system to display a realistic target and an instructor's console equipped with the instrumentation and scoring devices necessary to present the attack problem and to evaluate the student's gunnery score properly.

The prototype trainer utilizes a standard F-86D Flight Simulator which has been equipped with an optical gunsight. Since the flight platform is incapable of motion, roll, pitch or yaw, rate signals are fed directly from the flight simulator to the gunsight computer, thereby bypassing the sight rate gyros.

The target presentation system consists of a television pickup and projection system, which portrays a realistic simulation of air and ground targets, and constantly depicts a true-to-life situation between fighter and target, regardless of course, speed or type of maneuver. The target model, located in front of a television camera, is free to move in attitude and relative range so as to simulate the geometrical conditions prevailing. The image of the target is transmitted from the camera through the television projector and then displayed on the spherical screen surrounding the simulator cockpit.

Various analogue computers continuously solve the complex equations which describe the dynamic relationship between fighter and target. These computers provide azimuth and elevation positional data to the target projector as well as altitude, attitude and range information to the target model. Thus the complete freedom of maneuver and attack pattern, inherent in the real situation, is duplicated in the trainer.

The display screen is a segment of a sphere of 10-foot radius. It has an azimuth span of 240 degrees, elevation span of 120 degrees (70 degrees above the horizon, 50 below), and a mean height of 18 feet. The screen is composed of self-supported panels of plastic resin impregnated fiberglas molded over a honey-comb structure. The simulator cockpit is so positioned that the pilot's head is located at the optical center of the sphere. From this position the pilot can observe a target at any location on the screen without any apparent distortion.

A second projector is mounted above the cockpit and is so arranged that it casts an image on the screen depicting sky and earth with respect to the interceptor aircraft. This projector is free to rotate so as to simulate the relative effect of roll, pitch and yaw.

The necessity for some visual earth reference was proved by actual tests conducted with the trainer. A veteran fighter pilot attempted interceptions on a bomber-type target while the horizon projector was inoperative. He consistently lost control of his aircraft and had to abort the attack and utilize his instruments in order to recover. When the horizon presentation was restored, the same pilot had no difficulty in maintaining control during the interception.

The instructor's console is equipped with target flight controls and instruments, television monitoring equipment, scoring clocks and recorders indicating errors in azimuth, elevation and range. In addition, the flight instructor is provided with a duplicate set of flight instruments and a "fault" panel with which he can introduce any operational malfunction that might occur in actual flight.

The instructor, by means of a selector switch at the console control station, may select either an air-to-air or air-to-ground problem for the student. Assuming first that the ground target is selected, and the mode of attack (gun, bomb or rocket) is chosen, the instructor will position the target somewhere within the operating radius of the simulated aircraft. He will then inform the student by interphone the nature and approximate location of the target to be attacked. The position of the target with respect to the student's aircraft is displayed in a cathode ray tube at all times. While the attack is in process, the instructor is informed continuously of the student's approach and tracking ability by a television monitor, meters and clock-type indicators. Simultaneously, a permanent record of the student's performance is obtained by operation of a multiple channel recorder.

If the aircraft target is selected, the instructor may, in addition to the foregoing, vary the course and altitude of the target and introduce bank and pitch attitude variations with a manual control stick, thereby simulating evasive tactics on the part of the target. If he desires, the instructor may operate a switch at the console to "freeze" the complete attack problem. In this manner he is able to advise the student and comment on his attack procedure at any time.

In pursuing and attacking the target, the student must exercise full control over his aircraft, and except for such factors as vibration and acceleration forces on his body, the system closely simulates true flight conditions on the display screen and on the instruments in the cockpit.

The gunnery training portion of this device is quite flexible and can be attached easily to any modern flight simulator. The F-86D simulator was utilized on the developmental model because it was the only one available at the time. Present plans are for a production quantity of gunnery trainers utilizing the F-100 simulator as a flight platform.

In the development of a device of this size and complexity, several basic decisions must be made early in the program. Probably two of the most important questions involved in the design of the F-151 were, "What is the scope of the gunnery training problem which this trainer shall encompass, and what will be the initial skill level of the student?"

The scope of the training problem to be provided for in this trainer is very clearly defined in the Visual Contact Gunnery Trainer Study conducted by the American Institute for Research. Skills, behaviors or techniques to be trained on this device may be summarized as those necessary to navigate a fighter to a place of combat, to make air-to-air and air-to-ground attacks and to break away successfully or recover from such attacks.

Simulation by this trainer was limited to those techniques involving the use of an optical gunsight. Simulation necessary for any special techniques or procedures will only be provided incidentally; no special provision was made for such purposes in the prototype model.

It was assumed by the Wright Air Development Center project engineers, responsible for the development of this trainer, that the equipment would be used for both training in the basic gunnery skills and at squadron levels as an aid in maintaining proficiency. In the absence of the Air Force training curriculum which will be employed with this device, no assumptions have been made as to the training time to be spent in the trainer versus time in operational aircraft. However, it is obvious that a trainer of this type should reduce considerably the flying time required to reach any particular level of skill. It should be noted at this point that the purpose of the F-151 is not to eliminate or reduce flying time, but to provide the Air Force with a more effective pilot-fighter combination.

In the operational squadron a measurement or evaluation of the student's ability becomes even more difficult than in the training phase. Here the student must learn to evaluate the situation and choose the best tactics. The static situation of tow target position and speed no longer exists; instead, thought and action must be practically concurrent.

A summary description of a good fighter pilot, as determined by research conducted in combat theaters, is quoted below:

"An ideal fighter pilot is primarily a person who thinks and acts quickly and accurately. His actions are sharp and decisive and reflect good judgment, superior ability in identifying speeds, altitudes, range, other distances and an alertness to everything that is going on around him.

"In addition to the traits previously mentioned, the ideal fighter pilot has a strong desire to fly and is eager for combat. He is aggressive, but is cool and collected, has good control of his emotions, and can be depended upon to do the jobs assigned him."

Obviously the F-151 cannot instill all of the aforementioned traits in a pilot. However, there are many pilots who possess these qualifications but still are not good fighter pilots. Therefore, there must be some variable which provides the solution to the very complex equation involving the dynamic characteristics of the aircraft, the fire control system and the pilot. Only after solving this equation can the pilot achieve success in combat engagements. We at WADC feel that the key to a successful solution of the problem is proper training and sufficient practice.

Veterans of the Korean theater who have flown the F-151 were enthusiastic about the possibilities of this trainer, both as a device for teaching basic gunnery skills and as a means for teaching approach or positioning tactics against another fighter of approximately equal flight characteristics.

The old saw to the effect that practice makes perfect certainly applies to gunnery techniques. But, up to the present time, practice in fighter tactics has always had to be done in the air. This is not only expensive but the time consumed traveling to and from the gunnery range and on-the-ground down time of aircraft limit the amount of training that can be obtained.

If a trainer of the F-151 type were available, much of this necessary practice could be obtained on the ground and at a greatly reduced cost. Time normally lost in aircraft could be utilized effectively in trainers. The trainer would provide an opportunity for practice in tactical situations that normally are not attempted in the air. The constant presence of an instructor would result in errors being detected and pointed out when they occur. Furthermore, the scoring means provided in such a trainer would provide a more consistent method of student pilot evaluation.

Even though the development of the F-151 Fixed Gunnery Trainer represents a major advancement in the art of visual flight illusion, personnel who have been associated closely with the project feel that this is only the first step.

It now appears quite feasible to provide a greater terrain coverage by utilizing a wide-angle television system. This could broaden the scope of the trainer to permit simulation of takeoff and landings, low altitude bombing or any special mission requiring accurate terrain simulation. It is feasible also to tie two F-151s together; this would result in a fighter vs. fighter combat trainer.

The developmental model of this trainer is now being installed at an Air Force Base, where it will be subjected to functional and operational suitability tests over a period of time. It is anticipated that the production model of this device will find widespread usage in the Air Force training program. ●

Get The FULL TREATMENT

Reprinted from the MATS FLYER. By Lt. Col. James M. Fahey.

WHEN I GO into a weather station during my flight planning, it is for one purpose and only one purpose — — to get a weather briefing. The full treatment. Before going in, it's a good idea to review the weather factors and then make sure you are told about them.

You know, sometimes these forecaster chaps, despite checklists and other memory devices, forget an item. Not often, but sometimes. So you make sure you get all the poop by knowing what is needed and by asking when it's not given.

Do you recall that jet pilot who forgot to ask the forecaster for the runway temperature and pressure altitude? The forecaster didn't include them in the briefing because they were not critical.

Well, this chap didn't bother to calculate his takeoff roll. As he rolled down the runway, it disappeared but fast. The book says he could and should have made it. He didn't know, so he cut power, picked up the gear and slid onto the overrun. When flying a jet, get that info and calculate the takeoff roll! I do, and I didn't have to wait for a TWX from USAF to make me do it either.

Entering the weather station, I clench my fists, grit my teeth and fight back that overwhelming urge to get to the sequence board to see what my destination is reporting.

Forecasters used to peeve me when they'd drag me through the current surface chart, the upper air charts, the progs, the severe weather warning chart, the pireps and the rareps. It always seemed that they were just trying to show how much they knew. "A forecast, quick!" was my attitude.

One pilot changed all that. He was the pilot who called in by telephone, on a squadron clearance, and told the forecaster that all he wanted were the winds and the terminal forecast for the destination. He was doing okay until he got to his destination and started a letdown.

Just as the dawn glistened off his wings, the fog rolled in and he had to go elsewhere. He was short on fuel because of other mistakes and couldn't wait for an alternate forecast to be processed through Approach Control. So he headed north. You guessed it. He sat down in a fog-engulfed cornfield while airfields galore to the southwest, south, southeast and east glorified in the clear, fresh dawn.

His impatience cost him the general synoptic situation which could have told him where the fog was. The weatherman miscalculated its speed of movement, but the pilot could have known that north was not the direction to seek refuge.

My desires for a quick briefing vanished like a gorgeous blonde at the office Christmas party when I read another crash report. One of the boys in the office, looking into an accident blamed on weather, found that the chap actually didn't get the full treatment in his briefing.

He was soaring along above an overcast-to-broken deck when he began to have radio trouble, so he decided to make a stop en route. He spotted a hole near an airbase and peeled on down. The descent was uneventful until the base of the clouds was passed. It was too late then to know he was only a couple of hundred feet above terra firma. The altimeter was reading 21 feet—underground.

True, the weatherman didn't brief him on that base's weather, but remember my first point. Weather en route is a prime factor. Heck, you don't know when you might lose an engine or two and want to know where to go — quick like.

Funny thing, you know we've been overestimating these weather forecasters all along. They make like pretty sharp characters, but the other day a pilot walked into the weather station and asked which was the best weather route to his destination.

The weatherman gave him a briefing on a route which, instead of being a straight line, called for a dogleg flight east of the mountains with a late swing to the west. Everything seemed okay, so the forecaster signed the clearance, not recognizing that the route indicated was *direct*.

To make it short, the pilot flew the direct route and down came the boom. He went smack dab into one of those "black areas" with severe thunderstorms, turbulence and hail. The latter did enough damage to cause a landing at an auxiliary field.

The pilot blamed the forecaster for not briefing him on the "black area." The forecaster blamed the pilot for not flying the route as briefed.

Brother, one thing to make sure of is that the forecaster understands where you're going.

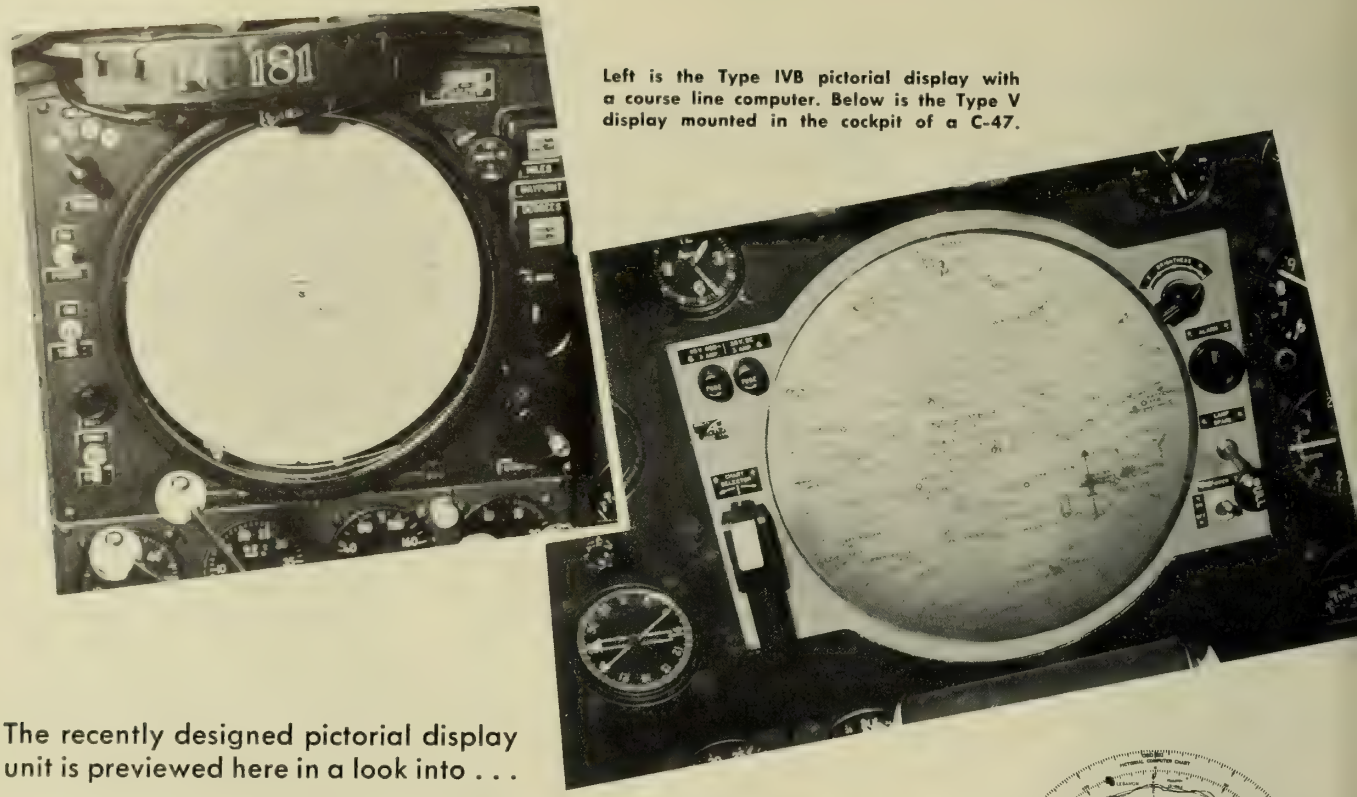
But even in your cockpit you are not out of the weather business by a long shot. After takeoff, get a reading as you pass through the base of the clouds and call it back to the tower with a request to pass it on to weather. Do this again as you pass through the tops.

Many times I have asked a weatherman if he had any reports on cloud tops, only to find that he was as denuded of pireps as the Christmas turkey is of meat when it's passed my way. Right now, I'm the best cloud-base-and-top indicator in the Air Force, bar none.

Remember, the weathermen are pumping out terminal forecasts periodically, on a vast network of stations. So when the forecast isn't clicking by the numbers, just pick up the microphone and ask for the latest forecast. We can get terminal forecasts from CAA stations, airbase control towers, approach controls or even from the forecaster direct on VHF pilot-to-forecaster if necessary.

Most of the same can give you a route forecast. Why stand by on an old forecast when the Air Weather Service has all those forecasters down there ready to help?

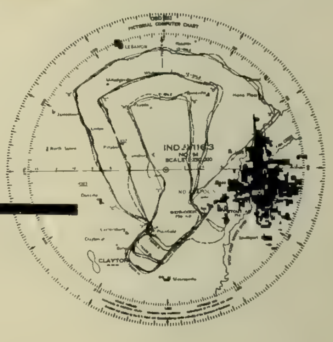
Well, after a grease job on the landing, I always manage to find a few moments to drop into the weather station and give them the story of the flight. Who knows, maybe a friend of mine will be heading the opposite way and can use the info. ●



Left is the Type IVB pictorial display with a course line computer. Below is the Type V display mounted in the cockpit of a C-47.

The recently designed pictorial display unit is previewed here in a look into . . .

Tomorrow's New View —



HAVE YOU ever wished that your actual navigation could be as simple as your preflight planning? It's almost that easy with a pictorial display. A pictorial display converts the information from a VOR/DME receiver to an automatic symbolic representation of your aircraft and its position on a chart of the area over which you are flying.

Operating and technical personnel have for years recognized the value of displaying navigational information in a pictorial form in order to reduce the workload on the flight crew and add flexibility in the selection of desired ground tracks. With the adoption of VOR/DME navigational facilities, the advantages of a continuous indication of position information in a simple and direct form increased the interest in pictorial display devices.

Initial studies conducted by the Departments of Defense and Commerce, aided by the Aviation Psychology Lab at the University of Illinois, resulted in a development and evaluation program sponsored by the Air Navigation Development Board and conducted at the CAA Technical Development and Evaluation Center on three types of displays. Since these three displays were developed to evaluate the various features of pictorial displays, the original specifications included as many of the most desirable proposed features as possible. Many of the advantages and possible applications of airborne pictorial displays were outlined in a previous article entitled "The Automatic Way," in the August 1954 issue of FLYING SAFETY.

The Type III Portable Pictorial Display, manufactured by Aero Electronics Company, consists of a display unit and an amplifier unit connected by a five and one-half foot flexible cable. The display unit is approximately eleven and one-half inches in diameter, four inches deep, weighs about nine pounds and has a fixed circular chart holder, an aircraft position indicator assembly and a small control panel.

The special aeronautical charts used with this display are 10 inches in diameter, with the VOR/DME station at their center. A chart is inserted after lifting a clear plastic bridge on the top of the unit. The aircraft position is indicated by a small hole in a piece of clear plastic which moves along the bridge assembly. The distance between this hole and the center of the chart shows aircraft distance from the station. This entire assembly also rotates over the surface of the chart to indicate the bearings to or from the station. An azimuth scale is engraved around the chart holder. The point of a pencil may be used to mark the position of the aircraft at any time, or to trace a continuous track.

The two controls near the bottom of the display unit are the power switch and a three-position selector switch which must be set to the scale of the chart being used. During evaluation tests, special charts corresponding to the scale of local, sectional and world aeronautical charts were used. To operate the display, the VOR/DME station is tuned in, the power switch is turned on, a chart of the desired scale is chosen and inserted and the scale selector switch is set properly.

When the aircraft position indicator nears the edge of the chart, the next VOR/DME station along the route of flight is tuned in and a new chart is inserted. The scale selector switch should of course be checked to insure that the switch position and size of the chart agree. If flight beyond the range of a station occurs, or if display error becomes excessive for any reason, the flag on the course deviation indicator will warn that display indications are not correct.

One noteworthy feature of the Type III display is its portability. No space on the instrument panel is used and the display may be placed out of the way when desired. Although this unit was originally designed to be carried on the lap of the pilot, experimental preliminary flight tests indicated that this was undesirable because of weight, heat generated and interference with necessary operation of aircraft controls. In later evaluation tests, the display was supported between the seats of the pilot and copilot, and a bracket was provided to hold the unit when not in use.

Following the current trend toward compactness, an improved version of a portable display was designed and built at the Technical Development Evaluation Center. This version, designated the Type IIIA, is transistorized and consolidates the display and amplifier units into a single nine pound unit which is eleven inches square and two and one-half inches deep.

Charts are printed on translucent plastic sheets which are inserted manually. Chart scale selection is automatically taken care of by small coded perforations on each chart which adjust the distance servomechanisms. Aircraft position is indicated by a small point of light which shines from beneath the map, and although the aircraft heading is not displayed, a small tiller indicates the direction of progress by adding a tail to the spot of light.

The Type IV Rotatable Panel Pictorial Display consists of a display and an amplifier unit, and is manufactured by the Sperry Gyroscope Company. This model combines the display with a course-line computer.

The Type IV display is mounted on the aircraft instrument panel (Figure 1), and requires an opening that is fifteen and one-quarter inches wide and twelve inches high. The unit is nine inches deep and a plastic window covers the circular opening on the face of the display. Charts ten inches in diameter are used and a cantilevered transparent arm supports a small red arrow to indicate the aircraft position. The arrow also indicates the magnetic heading of the aircraft when used with a Magnesyn, or similar system.

The charts are printed on heat-sensitive recording paper and are mounted on metal backing discs. Tracks may be recorded permanently by the stylus under the aircraft position indicator. This stylus, in contact with the map surface during operation, is a fine wire which, when heated by an electric current, melts a small spot on the white map surface. As the stylus moves over the map, this spot generates a permanent black line, recording the track of flight. The indicator arm assembly automatically moves out of the way when the hinged door is opened to insert the charts.

Controls on the panel of this display include the power switch, the scale selector and trace switch and a flag alarm. The same steps, in general, are necessary for operation, as with the Type III display. Integral edge lighting is incorporated, and for those who dislike mental gymnastics, a knob is provided to rotate the chart in order to proceed up the map during flight in any direction.

The Type V Pictorial Display, manufactured by the Arma Corporation, is a panel-mounted optical projection unit which is extremely simple to operate. Figure 2 shows this display mounted in the cockpit of a C-47 aircraft. After only two manipulations, i.e., turning on the power switch and selecting a chart, the pilot has an operating display of his position and heading.

Charts are printed on a 100-foot roll of 35mm film and are projected on the rear of the display screen which is 10 inches in diameter. To select a chart, the slewing handle at the lower left of the panel is turned in either direction. This moves the charts in sequence across the screen. The degree of turn governs the speed of film motion. The center of a small aircraft silhouette, projected on the screen, indicates position. Rotation of the image corresponds with actual magnetic heading. A spare projector bulb may be placed in position by pulling a knob provided on the panel. Image brightness may be adjusted by the pilot to permit operation under varying light conditions.

Operational evaluation tests conducted at the Technical Development and Evaluation Center indicate that these displays will provide the pilot with continuous position information within the range of any omni-bearing and distance facility. Direct presentation of aircraft position on a map decreases the workload of the pilot considerably when compared with the use of symbolic display systems. The pilot is not required to translate instrument readings into a visual picture of his position. This automatic and continuous indication of position with a reduction of mental workload allows the pilot more time for other in-flight tasks.

This type of presentation also provides simplified navigational guidance in all directions from all points. That is, present radio aids and aircraft instrumentation limit continuous navigational guidance to certain specific tracks, these tracks being radial, or, in some cases, orbital with respect to the ground radio facility. With pictorial presentations, no such restrictions apply.

With more efficient use of air space possible, improved air traffic control procedures can be developed to reduce air traffic congestion and delays. Air traffic controllers can use additional air space to expedite traffic movements by providing lateral separation, whereas vertical or longitudinal separation is required with present navigational equipment and instrument flying procedures.

With the exception of ILS, pictorial displays can provide accuracy comparable to navigational methods now used and has the advantages of simplicity and versatility.

Although these navigation systems are still in the experimental stage, they do show great promise. Whether the Air Force will adopt similar systems or modifications thereof is purely conjecture, but eventually we'll all be using something on this order. It doesn't require a crystal ball to foresee automatic linkage with Volscan, visual navigation reference units, radar eyes for instrument flight and completely automatic let down and landing systems.

The All Weather Air Force comes closer to reality each and every day.●

Keep Current

NEWS AND VIEWS

Balloons in Color — Often mistaken for flying saucers, approximately 800 balloons per day are released in the United States to measure weather elements aloft. Balloon observations are taken four times a day from almost every government and military weather station.

The smallest balloon is approximately one and one-half feet in diameter and is used to measure the heights of clouds. These are either black or red and expand to about three feet before bursting at an altitude of 15,000 to 20,000 feet.

Two types are released daily to obtain data used in computing winds aloft. The smaller expands to a diameter of three to four feet before bursting aloft. The larger balloon expands to about six and one-half feet before bursting at around 50,000 feet. These balloons are colored white, red or black and at night carry a small white light for tracking purposes. The smaller balloon may, on occasion, be colored orange or yellow under special sky conditions for easier tracking.

Uncolored translucent balloons used to carry radiosondes, measure six feet in diameter before release and expand to 26 feet before bursting above 80,000 feet. The radiosonde and red parachute are attached to the balloon by a 100-foot line. Weather stations may release as many as four a day to obtain pressure, humidity and temperature data.

On occasion a larger balloon measuring 73 feet in diameter is released to soar over 100,000 feet. These balloons carry a wide variety of equipment for specialized atmospheric research purposes.

★ ★ ★

New Bird—Designated the Hercules, the YC-130 is built by Lockheed Aircraft Corporation and is currently undergoing flight tests in California.

It is designed to take off from short runways with personnel or cargo, fly higher and faster than existing military transports, land on rough makeshift airstrips and serve as a transport in longer-range logistical movements. The YC-130 measures 132 feet from wingtip to wingtip, is 95 feet long and 38 feet high.

Powered by four Allison T-56 turboprop engines, it develops a total of 15,000 horsepower. Test pilots state that its fast-acting propeller reversal mechanism enables the YC-130 to land and stop on extremely short runways.

★ ★ ★

Trainer—A prototype of what might be a standard cockpit procedure training aid in the future is being installed at some AF bases for evaluation.

The device, the Stanley T-33 cockpit procedure trainer, provides a method of teaching normal and emergency procedures to student pilots and rated personnel in transition from a reciprocating aircraft to the T-33.

This trainer provides complete cockpit representation of a T-33 and a console panel where the activation of the controls and instruments by the

Left and above, the B-66B light bomber made its initial flight on 4 January 1955. It carries a crew of three in a pressurized air-conditioned compartment. Special features include a single-point fueling system and a thermal-cycle de-icing system for the wing and empennage surfaces. The B-66 has two Allison J-71s, a wing span of 72 ft., a length of 75 ft., is 23 ft. high and grosses 78,000 lbs.

Below, two supersonic twins used for USAF's high speed, high altitude research program.

The new Lockheed YC-130, a turbo-prop aircraft designed as an all-purpose military transport.

student is monitored by an instructor. The instructor can declare any emergency, such as a flameout, fire or hydraulic failure. The student's procedure technique, in response to the situation, can be observed by the instructor through the use of signal lights on a control panel.

It is not contemplated that the trainer will reduce flying hours but it is considered a possible answer to the much needed introduction of the pilot to alien or complex equipment or unusual situations.

★ ★ ★

Twin Bells – The Bell X-1B has joined its sister ship, the Bell X-1A, at the Air Force Flight Test Center, Edwards AFB, Calif.

Identical except for instrumentation, the presence of both aircraft at Edwards provides the Air Force with a double-barrelled opportunity to accelerate its investigating of the aerodynamic effects of supersonic flight at high altitudes.

Neither the X-1A, which has attained a record speed of 1650 mph and a record altitude reported to be 90,000 feet, nor the X-1B is intended to be a tactical aircraft. Both are flying laboratories, equipped with approximately 1000 pounds of complex instrumentation. Operations of these types of aircraft have provided the Air Force and NACA with data already applied to current and future tactical aircraft and guided missiles.

Both aircraft are powered by rocket engines, and while designed for take-offs from the ground, the planes normally are carried aloft and launched from a B-29 mother-ship at altitudes over 25,000 feet.

Although the X-1B is the sixth and last of the X-1 series of airplanes which Bell Aircraft built for the Air Force, it is essentially the same plane that was designed in 1945.

The main differences between the original X-1 and the X-1B are that the latter is nearly five feet longer, has an increased fuel capacity and is equipped with a turbine pump to force-feed propellants to the rocket engine.

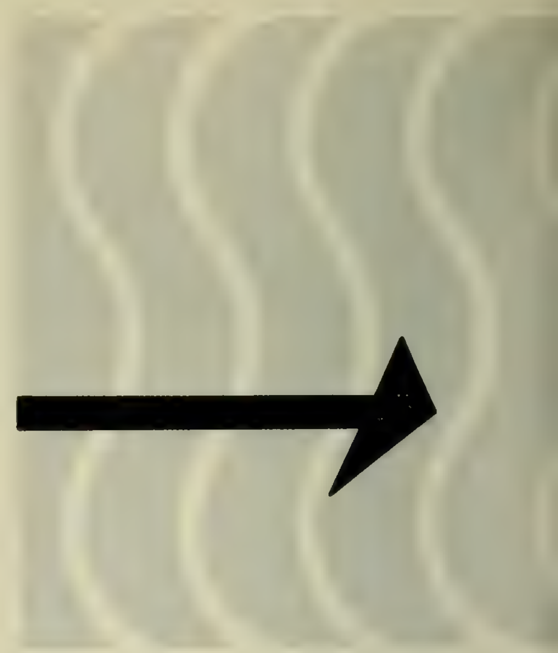
The X-1B is 35 feet, 7 inches long; 10 feet, 8 inches high, and has a wing span of 28 feet. Fully fueled for launching, it's gross weight is over 16,000 pounds.

In general contour the X-1B resembles a .50 caliber bullet. The aircraft is made of polished duraluminum and, like the rest of the X-1 series, is considered to be a very sturdy plane.

The engine burns an alcohol-water mixture and uses liquid oxygen as an oxidizer. It is cooled regeneratively by these propellants. Flight endurance under full power conditions is approximately 4.2 minutes.

Entrance to the pressurized but unrefrigerated cockpit is from above. The jettisonable canopy is made of plexiglas but the windshield is a specially tempered glass. At present, an ejection seat is being installed in the X-1A.

THE NEW APPROACH TO ROUGH AIR



IN SEPTEMBER 1954, many of the more important aspects of thunderstorm flying were covered by FLYING SAFETY. We hit at the subject both from the point of view of the weather forecaster and the structural engineer as well. Since that time, some additional investigative work has been accomplished by personnel of the All-Weather Testing Group at Wright Air Development Center.

As a result of the findings by WADC, the time is not far off when virtually all penetration speed bar graphs will be discontinued from Flight Handbooks and penetration speeds will be based on "power on" stall speeds instead. Some positive steps have been taken in that direction already, but of necessity, complete changes will take time.

One of the most widespread and frequent problems of weather flight is operation in turbulent air. Military specifications require that comments on turbulent air be included in the Handbook of Flight Operating Instructions for each aircraft. The Directorate of Flight and All-Weather Testing was asked to compile a realistic presentation because of the general dissatisfaction with the method presently used. Such dissatisfaction has been expressed by flying personnel on many occasions.

The present turbulent air penetration charts show indicated airspeeds for flying average gusts (30 feet per second) and high gusts (43 feet per second) in terms of weight, altitude, stall and structural failure. Regardless of the various titles used (mild turbulence, average gusts and so on) computations for the charts are based on the penetration of a sharp edged gust with an effective gust velocity of 30 and 43 feet per second. The choice of effective gust velocities of these magnitudes was based on very preliminary results of the joint thunderstorm project conducted by the USAF, NACA, U.S. Navy and Weather Bureau.

Actually the highest recorded effective gust velocity during this project was found to be 43 feet per second, so that value became the high gust. The choice of 30 feet per second as an average gust is even less justified. An unbiased sample of 24 thunderstorms chosen at random from the project revealed a total of 13,315 gusts having effective velocities of over four feet per second. Of these total gusts, only 13 were 30 feet per second or greater. This hardly justifies a 30 feet per second gust as "average" much less "mild." But, the penetrated thunderstorms were not in the "black area" category as defined by the Severe Weather Warning Center.

With the foregoing in mind, it was determined that the bar graph method of determining penetration speeds was not realistic. This led to a search for a solution to the problem. How should penetration speeds be analyzed and presented to pilots?

It appears that present methods for presenting turbulent air penetration speeds are not only difficult for th pilot to use and remember, but als that they may be misleading. Th panacea would be a single airspee for all cases. This would enable pilot to set up the airspeed befor penetration, or if he encountered storm accidentally, he could slov down to the general range of selecte speed. When selecting this given airspeed a pilot would have to conside gust intensity, gross weight, structural integrity, handling and altitud problems. Since an airspeed is to b chosen, each of these consideration will be evaluated with regard to th most desirable airspeed. No consideration is given to cruise control o fuel conservation in the selection o an airspeed.

- *Gust Intensity*—This is a functio of atmospheric conditions and canno be controlled. However, the accelerations received from the gusts are directly proportional to airspeed. Henc this consideration would warrant slow airspeed.

- *Gross Weight*—Weight is indirectly concerned in this problem sinc little can be done to change it in cas turbulence is encountered. Howeve it has a definite effect on selectin the correct airspeed.

- *Structural Integrity*—This can b compromised most easily by a combination of over-controlling (maneuver loads) and turbulence (gus loads). In most cases the higher th airspeed when an aircraft is displace from its flight path, the greater a the loads to recover. On the other hand, at very low airspeeds, sloppy response invites over-controlling. Therefore, the optimum airspeed would be one high enough to allow good handling but not in the range to introduce excessive loads that might cause structural failure.

- *Handling Problems*—It is known that instrument flight at higher airspeeds requires a higher degree of pilot skill and greater concentration. It is also known that the effects of accelerations are greater at high speeds.

The combination of these two conditions introduces a handling problem that can be alleviated by choosing an airspeed somewhat lower, yet high enough to maintain good flight handling qualities.

- *Altitude Problems*—Altitude encompasses consideration of gust intensity, structural integrity and handling problems. The operating range between stall and maximum airspeed (or buffet) decreases with altitude.

Since none of the problems above has given high airspeed as an optimum solution for turbulent air flight, it would seem logical to pick a satisfactory low airspeed. The lowest speed possible, would be just above a stall. Inasmuch as stalling speed is effected by gross weight, configuration and acceleration, it appears desirable not to select a fixed number as a penetration airspeed, but rather a number that is related to the stall speed. For an example, an airspeed of 60 knots above power on stalling speed has been analyzed for cargo and bomber aircraft. This is the average speed that these type aircraft fly on final approaches, with a 10 per cent safety factor added.

Most recommended airspeeds for instrument approaches are within 60 knots of the stalling speed for the weight and configuration under which the approach is made. These recommended airspeeds allow easy handling and accurate control of the aircraft. The highest of these airspeeds is about 200 knots for Ground Controlled Approaches because of the difficulty for the radar controller to handle the aircraft at higher speeds. All operational aircraft today are capable of making satisfactory GCAs. This establishes the fact that if an airspeed 60 knots greater than the stalling speed is chosen (which will generally be under 200 knots), positive handling characteristics are assured for present day reciprocating aircraft.

For cargo and bomber type aircraft this airspeed is not high enough to cause structural damage for severe gusts. There is considerable leeway between the limit load and the ultimate load where failure occurs. Loads in this higher range result from attempted recoveries or maneuvers rather than from gusts.

Since penetration speed is based on stall speed—and since the stall speed varies with gross weight and configuration—these items are automatically compensated for.

In the relatively slow speed range utilized in this example, accelerations are reduced and the most comfortable ride is provided. Because of this low airspeed, the question of the possibility of stalling should be answered.

All of the discussion here is based on a single gust—in fact, on a theoretical sharp edged gust which previously has proved satisfactory for this type of work. The possibility of actually stalling in a single gust is quite remote. Studies have shown that the average distance to the peak acceleration in a gust is around 10 chord lengths. For a large chord of 15 feet this would be about 150 feet to the maximum acceleration. Using the example of "stalling speed + 60 knots," if the very low stalling speed of 60 knots is used, this would mean the aircraft would be flying at 120 knots, or about 200 feet per second. The aircraft would completely traverse the gust (in this extreme example) in a second and a half. Even if a breakdown of airflow over the wings occurred (giving a theoretical stall), it would be so momentary that the inertia of the aircraft would prevent serious displacement.

The problem of stalling in turbulence, therefore, does not come from the gust but from the failure of the pilot to employ proper techniques to keep the aircraft in a level attitude. This must be controlled by recommended procedures which are based on maintaining a predetermined speed and attitude.

Considering all aspects, the choice of an airspeed 60 knots higher than stalling speed, for turbulent air flight appears justified. This is substantiated by actual flight tests of bomber and cargo type aircraft.

The greatest mass of the data was accumulated at 175 nautical miles per hour. The average stalling speed for the aircraft employed was found to be around 111 knots. Adding 60 knots to this speed would give 171 nautical miles per hour. This means the recommended airspeed, as determined by this proposed criteria, would give a speed very close to the one actually used to make any successful turbulent air penetration.

American Airlines conducted a thunderstorm investigation in Convair aircraft (similar to USAF T-29A) to evaluate airborne radar. Some 600 miles of flight including 40 thunderstorm penetrations were flown. The airspeed flown was 140 knots. The stalling airspeed for the pertinent weight and configuration here was about 100 knots. Adding 60 knots to this would give around 160 nautical miles per hour. This is well above the airspeed of 140 knots where it is known that successful penetrations were made. Further, it agrees with the American Airlines "Operating Manual-Convair" which states that when operating in turbulent air, airspeed will be reduced to 148-156 knots IAS.

These cases of repeated extreme turbulence penetrations are in good agreement with recommendations that the optimum airspeed for turbulent air penetration for bomber and cargo type aircraft should be the stalling speed of the aircraft plus 60 knots. Although there may be cases where other airspeeds are preferable for turbulent air penetration, this proposed "rule of thumb" will provide excellent flight characteristics and is a more realistic approach than the bar graphs presently used.

Turbulent air penetration presents less of a problem for fighter type aircraft because of their inherent characteristics. They are designed to undergo greater loads than the heavier aircraft and the personal equipment (safety belts, harness and helmet) available to the pilot helps prevent discomfort and injury. These two considerations allow a safe penetration without requiring the more exacting techniques used in larger aircraft.

The clean stalling speed for the F-84G at design gross weight is 127 knots. The optimum airspeed determined as a result of actual penetrations during the all-weather tests of the F-84G was between 220-260 knots. The F-86D, a swept wing fighter, stalls at about 115-120 knots. Flight tests determined the optimum penetration speed to be somewhere around 240-250 knots.

From these examples, it appears that twice the stalling speed provides adequate handling for turbulent air penetrations by any modern fighter. ●

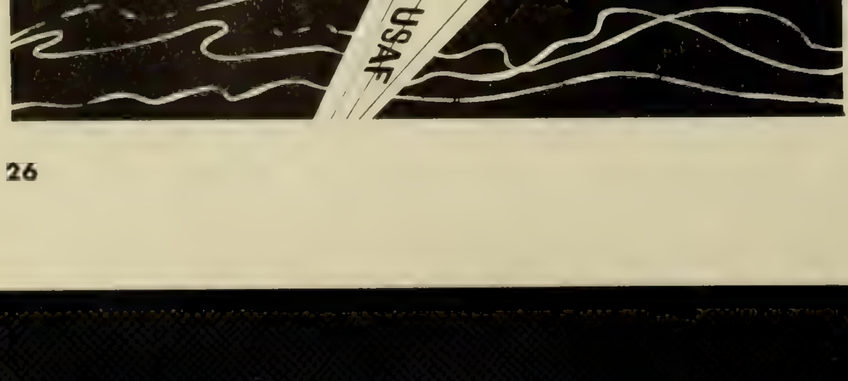
when you're in the soup...

Capt. John F. Welch, 28th Strat. Recon. Wg., Ellsworth AFB, S. Dak.

IN THESE days of stretching the dollar, the Air Force is looking for every possible means of cutting costs. We must reduce operating overhead and accident rates. We must cut down direct costs wherever possible by obtaining the maximum in personnel efficiency.

Proof of efficiency in our training is not to be found in the number of hours we fly. Rather it is in the amount of actual practice in essentials that we get while flying. If we can finish our required training in fewer hours than scheduled we display greater efficiency as a result of savings in fuel, parts and other direct operating costs. When the requirements of a training mission have been completed unnecessary time spent in the air is likely to be sheer waste and wears out aircraft which might be critically needed.

The pilot of the C-47 was lost and had the 9000-foot level all to himself.



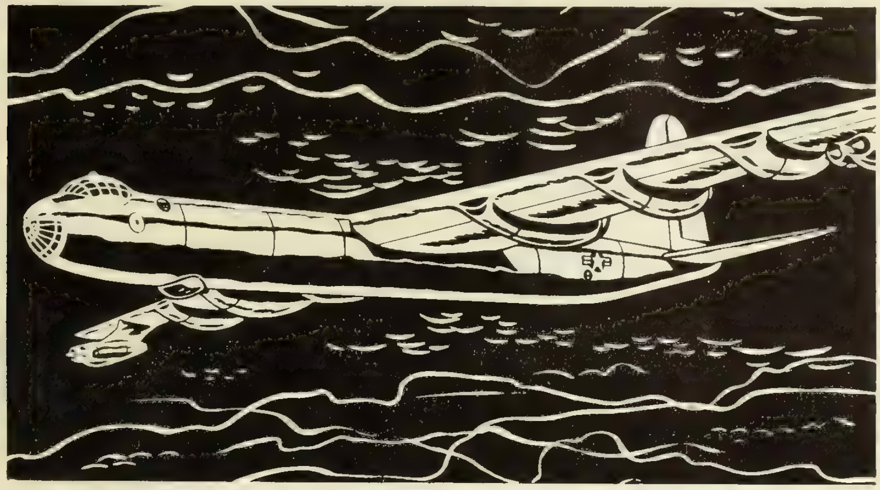
The attitude of the airlines is that every unnecessary minute in the air reduces profit. We're in business for profit, too. Our profit may be a little hard to measure since it consists of combat capability rather than dollars. But our returns, like airlines', must be as large as possible.

In their search for profit, the commercial carriers long ago were forced to stress minimum time in the air and minimum time lost at any particular stop. Time lost in making an instrument approach can louse up a schedule just as badly as time lost on the ground. So proficiency in making instrument approaches has been important to the airlines ever since they started to maintain regular scheduled operations.

The payoff is in greater efficiency in approaches — — that is, getting on the ground quickly and smoothly at the end of each flight.

Now, in order to attain this efficiency in instrument approaches, we must go back to *instrument proficiency*. Real instrument proficiency means the ability to conduct an effective instrument flight from takeoff to landing in minimum time. The purpose of this article is to show how each pilot can, by maintaining and sharpening his own proficiency reduce traffic control problems and contribute to efficiency of operation

Let's consider an example. One night last spring, an RB-36 arrived over its home base at 14,000 feet IFR The crew was in good spirits because the mission had been successful, the airplane was in good mechanical con-



Meanwhile the fuel supply of the RB-36 in the holding pattern at 10,000 feet was dwindling.

dition and there was still three and one-half hours of fuel aboard. The base was well above minimums and the alternate, only an hour and a half away, was CAVU. Prospects were good for a quick letdown, routine GCA and landing, debriefing, a short session at the "Scan" room, some hot chow and into the sack.

But at 9000 feet a C-47 was lost. It was overdue and could not be contacted by ground stations. In a brief, barely readable conversation with the RB-36, the pilot gave his position as approaching the station from the north. He reported VHF trouble, and asked the 36 to relay his request for approach clearance. Clearance was obtained from ARTC but the Gooney could not be re-contacted. Ground stations joined in trying to contact him, but with no success. So the C-47 had the 9000-foot level all to itself in all directions.

Meanwhile the RB-36 had entered the holding pattern and let down to 10,000. The comfortable fuel reserve started to dwindle. ARTC could not approve a letdown through the occupied 9000-foot level. The weather remained unchanged, 900 feet and 10 miles with snow showers, top of the overcast somewhere above 14.000. As 30 minutes lengthened into 15. the prospects of going to the alternate increased rapidly. Careful calculations allowed 15 more minutes of holding. After that, if approach time were still indefinite, immediate departure for the alternate would have to be made to insure arrival with minimum fuel reserve.

At about this time the C-17 pilot contacted a radio station 80 miles south of his destination. The lost pilot had finally oriented himself after a 50-knot north wind had caught him unawares. His radios were good; he had simply been out of range. Since he had only established himself on the south leg, position still somewhat uncertain, the C-47 pilot was cleared on in. The RB-36 was cleared behind him and landed, finally, an hour and a half after the initial approach was started.

The foregoing is an example of how lack of proficiency resulted in one crew getting lost and fouling up another. Fortunately the RB-36 had enough fuel to meet this particular situation. Under other circumstances the aircraft commander could have been forced to go immediately to his alternate or to declare an emergency. An emergency let-down through an altitude at which another aircraft is lost without radio contact would make an ARTC controller pull out what little hair he had left.

But this is not the entire story. In our example, efficiency also took a beating. Look what happened to the taxpayers' money. The cost of the extra fuel burned probably equals a month's pay for a pilot.

Another example occurred at a SAC base recently. The wing's aircraft were returning at approximately 30-minute intervals from a unit mission. We'll concern ourselves with only the last six.

Weather at the base was IFR and lowering. Since it was a maximum performance mission, none of the six aircraft had a large fuel reserve. The first three aircraft made instrument approaches and landed without incident, but by the time the third one was on the ground the ceiling was 600 feet. At 1050, the No. 4 plane was cleared from his position in the holding pattern at 10,000 feet, instructed to descend to 8000 on the east leg and cleared to GCA. The descent was not standard, but was used by ARTC because an airliner was climbing out on the west leg. Meanwhile, the fifth aircraft had requested a long range descent, cutting off a dogleg of the briefed route from 200 miles out because of a shortage of fuel. ARTC had let him descend as traffic permitted, and he arrived over the station at 12,000 feet at 1055, but did not request any priority. As No. 4 reported leaving altitudes, No. 5 was cleared behind him.

But trouble was brewing.

At this particular base it requires about 10 minutes in the GCA pattern from the GCA fix to landing. Descent from 10,000 feet to initial altitude should not have required more than five or six minutes. So No. 4 should have been on the ground about 1106. His let-down was so slow, however, that he did not ease down out of the soup onto the runway from his first approach until 1132. That was about 25 minutes too long.

For the crew of No. 5 that meant about 25 gallons of perspiration. Their fuel was already too low to consider going to an alternate, and the weather was now down to 400 feet. So, as you might expect, they didn't waste time. They were cleared at 1133, but because of poor visibility they missed their first approach at 1118. They were cleared immediately for another try and landed at

Number 6 needed two passes to get in; a few minutes later weather went below minimums.

1201. It was a good thing they did, too; they didn't have enough fuel left in the tanks to make another pass. Number 6, which arrived about 1130, also needed two passes and landed at 1230. The weather went below minimums a few minutes later.

A little more proficiency on the part of the crew in No. 4 could have eliminated the uncomfortably close shave experienced by the aircraft behind him. A little less proficiency could have cost the taxpayers an expensive airplane; perhaps several expensive crew members. As critical as the fuel supply was, a declaration of an emergency by No. 5 might have caused either No. 4 or No. 6 to have to declare one also; providing more problems for ARTC and the crews.

Air Research and Development Command has developed traffic control equipment which can control approaches at the rate of 120 aircraft per hour. (See "Volscan," FLYING SAFETY, April 1954.)

Probably we shall never try to attain such a rate on a sustained basis, especially with multi-engine aircraft. But no matter what the capabilities of the machines and instruments, until the day of the completely automatic landing, our rate of instrument approaches is limited by the skill and proficiency of the average pilot.

For jet operations, speed and proficiency in making instrument approaches are indispensable. You must be on the money the first time, and fast enough to give the following pilots their try at it. In reciprocating aircraft, under conditions of heavy traffic, efficient use of time is also of prime importance, as illustrated by the last example.

There is probably nothing in the following IFR suggestions that most pilots do not know already. It's just that occasionally we need to be reminded of them. They are offered in the hope that they can be used to improve instrument proficiency.

- Maintain a constant listening watch on one of the CAA frequencies. If you are listening on UHF, check the facility charts to be sure the stations for which you are listening have the equipment. If you do not have UHF, and VHF must be used for something else, have someone on your crew monitor the frequency of the nearest Omni or Low Frequency Range station. If you have been talking to a station and must change channels, tell the operator you will stand by on his range frequency. Be particularly attentive for a while after making position reports and when approaching fixes previously estimated. The Air Route Traffic Control Center may have a clearance or a weather report for you, or perhaps an emergency or a lost aircraft in your area.
- Keep constant track of your position. If you have radar navigational equipment, your radar observer can help you. But don't depend on him alone. Be alert for wind shifts and unpredicted winds. Don't let the weather get you lost.
- If your mission requires some time in the base area after arrival, be sure to tell ARTC of your plans. They may be able to work in under you those succeeding aircraft which wish to land immediately, if you let them know ahead of time. Also, they can plan a lower altitude for you, to let the next crew, with plans similar to yours, in above you.
- Comply with clearances promptly when you receive them, or request changes immediately. The reason for a new clearance may be to maintain separation between you and another aircraft, or to assist another aircraft in trouble.
- Accept approach clearance when it is given to you. If cleared for descent, start letdown immediately and make your approach as rapidly as possible. Descending at 500 feet per minute is good practice in instrument school, but you can and should let down much faster in your approach to the GCA fix or procedure turn.
- Make all requested reports during your descent as promptly as possible. Under ANC Manual, paragraph 2.04020, Control may descend aircraft a constant 1000 feet apart if the aircraft are in communication with each other. If that is being done, be sure to tell the pilot above you as you leave each 1000-foot level.
- If you are given a descent in a quadrant, on a bearing or on a leg other than the normal approach leg, go no farther from the station than the clearance requires, and return to the station or the normal letdown pattern as soon as the clearance permits. That way you can avoid getting lost and will be in a better position to begin a GCA or low approach upon reaching the proper altitude.
- Unless instructed by Control to do so, it is not necessary to approach the GCA fix from any particular direction, so long as your altitude will clear obstacles and terrain by 1000 feet. If your turn is made to the first GCA heading immediately upon station passage, you are normally assured of adequate terrain clearance and good GCA radar contact.
- If your fuel supply is below that required to get to your alternate, and landing base weather is poor, you are bordering on an emergency. Do not hesitate to declare an emergency if it is warranted.
- Don't forget the other crews. One of those behind you may need to save every possible minute, even if you do not.

Proficiency alone is no guarantee that a pilot will make an approach in minimum time. But if he is conscious of the problems of other flight crews and those of Air Route Traffic Control, and makes use of his proficiency, he will be contributing to a more efficient Air Force, and the Air Route Traffic controllers will have fewer nightmares, and, in the long run, we'll all save money. ●

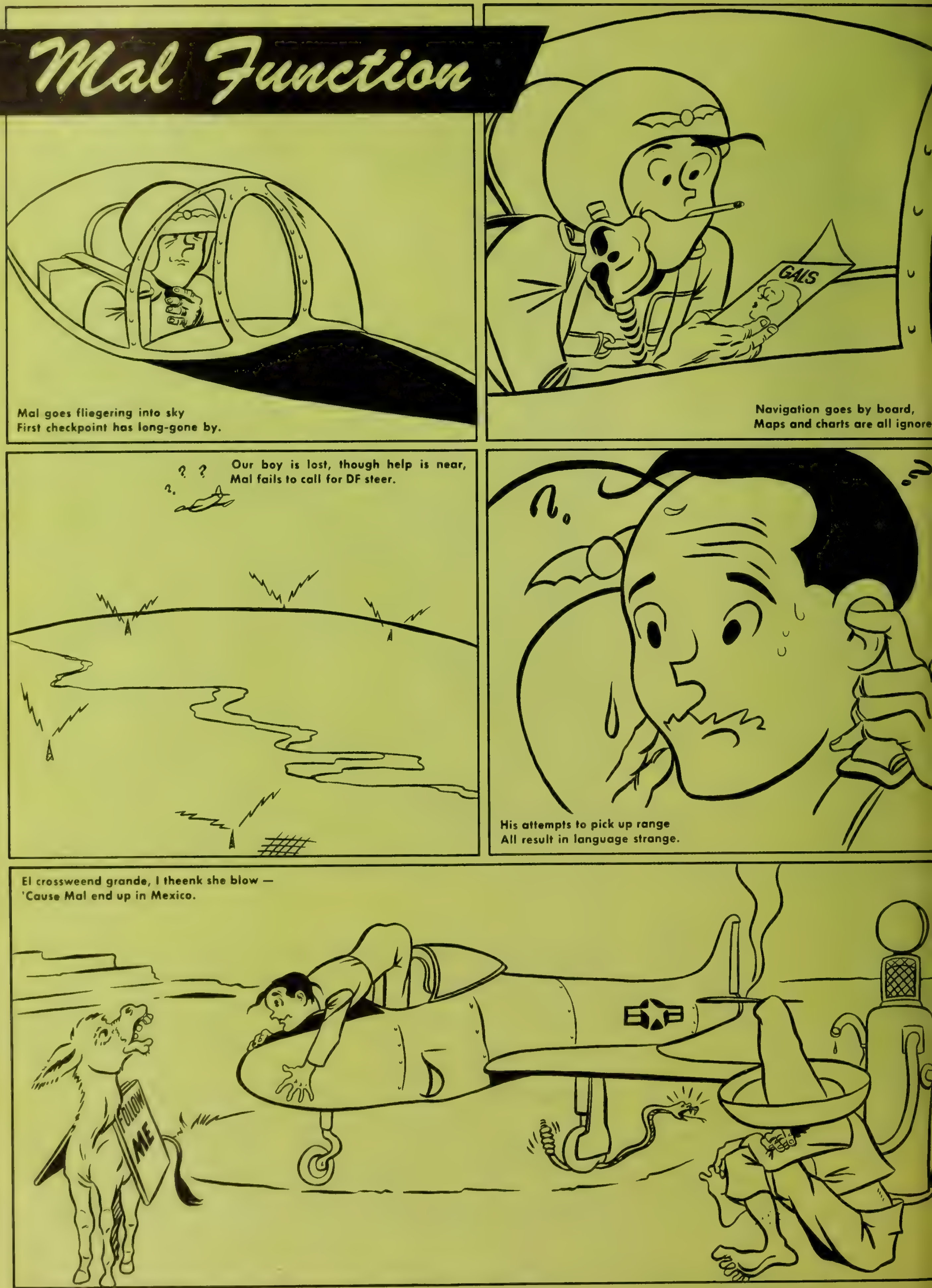
the Wind Doth Blow

Probably the best harbinger of spring is the March winds. They start melting the snow and ice of winter and furnish mankind with delightful previews of things to come: summer warmth, green fields and Bikini bathing suits. Sometimes they reveal some interesting facts and figures, but at other times these same winds can cause a bit of trouble for the unwary pilot.

The breezes that we enjoy on terra firma may well drift an aircraft far off course. We hope that will never happen to you, but if it does, remember the many aids that are available.

The story that starts on page 4 of this issue should not be overlooked by any reader. Becoming lost, misplaced or disoriented is unpleasant, but help is as close as your microphone.

Mal Function



Mal goes fliegering into sky
First checkpoint has long-gone by.

Navigation goes by board,
Maps and charts are all ignore

Our boy is lost, though help is near,
Mal fails to call for DF steer.

His attempts to pick up range
All result in language strange.

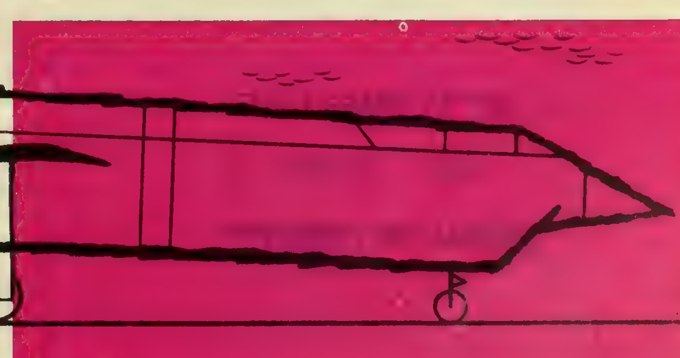
El crossweend grande, I theenk she blow —
'Cause Mal end up in Mexico.

4.15 65
L/S

APRIL 1955

FLYING SAFETY

UNITED STATES AIR FORCE



in this issue

- What's the Percentage?
- Situations Unlimited

FLYING SAFETY

VOLUME ELEVEN NUMBER FOU

Editor
Major Joseph P. Tracy

Managing Editor
Captain John H. Moore, Jr.

Associate Editor
Major Perry J. Dahl

Production Control
Major Ben H. Newby

Art Editor
M/Sgt. Steven Hotch

Art Assistants
T/Sgt. Carl E. Fallman
S/Sgt. Al. Fortune

Editorial Assistant
T/Sgt. William H. Johnson

Staff Photographer
T/Sgt. Nicholas Shekitka, Jr.

Circulation Manager
T/Sgt. G. J. Deen

Department of the Air Force
The Inspector General USAF
Major General Howard G. Bunker
Deputy Inspector General

Brigadier General Richard J. O'Keefe
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

Major Philip A. Watson, Jr.
Acting Supervisor of Flight Safety
Publications

CONTENTS

Pag

Crossfeed 2
The Future Is Here 3
Looking At The Maching Birds 4
Round Trip Ticket 1
Well Done 1
Fellow Travelers 1
You-Safe Co-op 2
Situations Unlimited 2
On Course With 60-16 2
What's The Percentage? 2
Danger! Missiles At Work 2

SUBSCRIPTIONS

FLYING SAFETY magazine is available on subscription for $3.00 per year domestic; $4.2
foreign; 25c per copy, through the Superintendent of Documents, Government Printing Offic
Washington 25, D. C. Changes in subscription mailings should be sent to the above addres
No back copies of the magazine can be furnished.

* * *

The printing of this publication has been approved by the Director of the Bureau of th
Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein hav
been extracted from USAF Forms 14, and may not be construed as incriminating under Article 3
of the Uniform Code of Military Justice. All names used in accident stories are fictitious. N
payment can be made for manuscripts submitted for publication in *Flying Safety Magazine*. Co
tributions are welcome as are comments and criticisms. Address all correspondence to the Edito
Flying Safety Magazine, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardin
California. The Editor reserves the right to make any editorial changes in manuscripts which h
believes will improve the material without altering the intended meaning. Air Force organizatio
may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organiz
tions must query the Editor before reprinting, indicating how the material will be used. The co
tents of this magazine are informational and should not be construed as regulations, Technic
Orders or directives unless so stated.

USAF PERIODICAL 62-1

Brigadier General Richard J. O'Keefe

Director, Flight Safety Research

Brigadier General Richard J. O'Keefe will leave the Directorate of Flight Safety Research, Norton Air Force Base, on April 20, 1955, for reassignment to the Pentagon, Washington, D. C.

Prior to receiving his assignment to Flight Safety Research, General O'Keefe held a number of important assignments including tours in the Canal Zone, Africa and Saudi Arabia. It was while in Arabia that he distinguished himself as Commander of Dhahran Air Field and later as Chief of the U. S. Joint Survey Group.

On March 17, 1951, General O'Keefe was appointed as Director of Flight Safety Research, Office of The Inspector General, USAF. Since then there has been developed the most effective aircraft accident prevention program in the history of the Air Force, as evidenced by a steady decline in the frequency of Air Force aircraft accidents as related to flying hours.

General O'Keefe is a command pilot and technical observer. His knowledge as an aeronautical engineer along with his keen devotion to duty have contributed greatly toward the overall Air Force effort of reducing aircraft accidents.

FLYING SAFETY salutes General O'Keefe, and with a hearty thanks for a job well done, wishes him . . . *Bon Voyage!*

LETTERS TO THE EDITOR

One Each Air Instructor

My present classification is "One each Air Instructor." My assignment to the 136th Fighter Interceptor Squadron of the 107th F-I Wing, New York ANG, Niagara Falls, N. Y. ($2.00 tours can be arranged to see the Falls.)

A few words on the reason and motivating forces behind this letter. As you can readily detect, it's my first one to you. My duties are to advise and assist the unit in every way that I can. Primarily to assist in the Flying Training Phase.

The 136th FIS served on active duty during the Korean emergency. When the unit was relieved from active duty, only a handful of the pilots came back with it, most remained in the active Air Force. So the task has been to rebuild the unit from paper and scratch. Our pilots are a rare mixture to say the least — former bomber boys, training commandos, cargo, MATS, civilian air lines, crop dusters—you name it. We have every type of driver there is.

Most naturally one of the major problems is accident prevention. The pilots are not under direct supervision as an active duty pilot is. They are all together only four days a month. The only means left to keep them current is through written directives and magazines such as FLYING SAFETY.

In order to assure ourselves whether the pilots are reading the material, and equally important, whether they are getting anything out of it, Captain Michael Svisco, Operations Officer, and I experimented with a test. The August issue of FLYING SAFETY was issued to each pilot on the 2nd and 3rd of October 1954, with instructions to read it.

On the 16th of October 1954, all the pilots were given the test. Results were as follows: Out of 12 questions and nine pilots participating, one pilot got 10 correct. one pilot got nine correct, four pilots got eight correct, and one pilot seven, six and five each, in that order. It shook and rattled them into realizing that they had been passing over some very good and important material.

This has been done before I'm sure, but thought you might be interested to know that our angle on accident prevention is to use the approach of flying education. This is only one of our ideas and steps that we are using or plan to use.

Major Nile C. Greer
Air Instructor
107th F-I Wg, NY ANG.

★ ★ ★

One Ear Receiver

If the following suggestion has not been made before I would like to suggest that the Air Force get rid of its present type headset and adopt a small one-ear crystal receiver. I have used one for approximately a year and find it very satisfactory from two standpoints.

First of all, it leaves one ear free to hear what your copilot is trying to say to you. Using the old headset, when the copilot wishes to speak to you, and the interphone is busy, both the copilot and the aircraft commander must reach up and remove their headsets. With one ear remaining free, this is not necessary.

Also. I find it more comfortable than the two-ear headset. The old type headset had a tendency to cut off the circulation in my head, causing a headache. This one-ear crystal set eliminates this trouble.

I have suggested this one-ear crystal headset to other aircraft commanders and pilots and not one has been dissatisfied with the idea, after giving it a good trial run.

For those who would like to try the idea, you can pick up a good crystal receiver for $1.50, take it to the radio shop and have them put a plug on it, and you're in business. To me the $1.50 expenditure is more than worth it in the comfort received.

Lt. Col. Bernard J. Bushue
372d Bombardment Sq.
APO 239

Sounds good to us. FLYING SAFETY would appreciate getting more ideas like this from the field to pass on to the troops.

★ ★ ★

Carburetor Trouble

We would like to point out a misconception in the November issue in the article "Beginning of the N." On page 16 the article states "Determining if the N has a Holly or a Bendix type carburetor is a good trick." The writer evidently has never seen a "Bendix N." The carburetor air intakes are shaped very much like the intakes on the reliable old "Gooney," considerably different from the Holley installations. A glance at the front of a B-25 will tell you if it has either Bendix or Holley carburetors.

We would also like to point out that the Bendix installation on the B-25 would seem to ice up more easily than the Holley does.

We read, avidly, every issue and think it's doing an excellent job.

Capt. Leallen French
1st Lt. Richard P. Schumann
1st Lt. Charles E. Phelps
Ralph W. DuMont
Flight Test Station
3575th M&S Gp, Vance AFB.

Men, you are so right. No "N" with the Bendix was available here for inspection. WADC required they be placarded when the new carb was installed so it was assumed that it was somewhat difficult to identify.

This month we are taking a bit of editorial license in order to call your attention to "Looking at the Maching Bird" which starts on page 4. This is no ordinary run-of-the-mill yarn. On the contrary, it presents some very solid facts concerning a relatively unknown phase of this flying business - - supersonic flight.

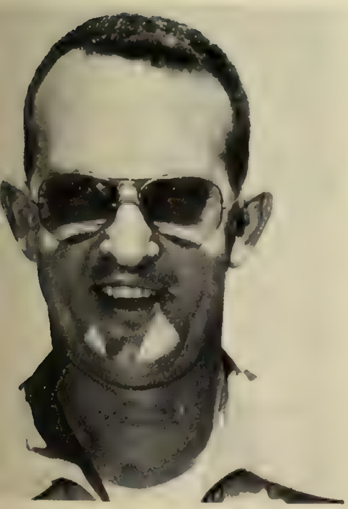
When we first started playing footsie with A bombs and other nuclear devices, few people realized how the little monster would grow until it was the tail that wagged the dog. Now it seems as though our designers are dragging us into aerial skyrockets that not only outstrip sound but will soon outstrip man's ability to cope with the beasts. It is conceivable that we well may be entering the final phases of manned flight as far as aircraft in warfare are concerned. The supersonic airplanes that we dreamed of yesterday are here today; and mañana will be here before we realize it.

One of the earliest to crack the sound barrier was Tony LeVier.

His thoughts on supersonic flight are reflected in "Looking at the Maching Bird" and to Tony and the men of his profession we render a sincere salute. They are the ones who are pioneering the way for things to come.

New concepts in speed are the order of the day.

...the FUTURE is HERE!



Back in the days of stick and wire airplanes, a young fellow named Tony LeVier got the bug to fly. As a matter of interest it may be noted that he checked out in an airplane long before it became necessary for him to master the techniques involving a safety razor.

Tony was suffering growing pains right along with the aviation industry and in a sense, they grew together. For more than 25 years he has been fooling around with a bit of everything that flies and today, as Chief Pilot for the Engineering Test Flight Section of Lockheed Aircraft Corporation, he probably has as great a share of aviation know-how as any man in the business.

Looking at the Maching Birds

THIS ARTICLE is based on a lecture delivered by Tony LeVier recently to the Los Angeles Chapter of the Institute of Aeronautical Sciences.

* * *

. . . then the "one minute flag" goes up. One minute away; sixty seconds from the start of this race. I tell you, you've never been so excited in your life. You sit there in the tiny cockpit and can see all around. The whole field, maybe the whole world is vibrating with excitement. The men on the wingtips and the man at the tail, holding you down as you rev up the engine (you don't have chocks or brakes), fight the prop blast and the tugging. You can feel the plane straining as though it were a thing completely alive. You're a part of it too, and you want to be unleashed. You want to go — leap aloft — be free of these restraining influences.

It isn't going to be an easy takeoff. Those little 10-inch wheels are hardly more than skids. The field is just a sod plot of ground and you know it's full of pot holes and ruts. You remember the last race. It was a short one too, but you had to put some gas in the tank back of the seat and it raised hob with the C.G. Now you've got gasoline in there again, only this time the tank is full. Where's the center of gravity? Maybe clear back by the tail post.

You didn't want all of that fuel but this race is just a bit more than important. This is it! 300 miles. A rectangular course around and around four pylons. This is the money race. You make it on this one or your name is mud. You've got to make it on this one or you'll be a has-been. Okay, the rear tank is full. Enough fuel to make the race. 45 lousy gallons.

The flag comes down. As the starter's arm descends, you open the throttle. There's no jar — no jolt. You just sit there with the little prop making an invisible blur, and the engine screams. Finally you feel the tiny racer begin to waddle forward. It's just that. A waddle. Earle Ortman is

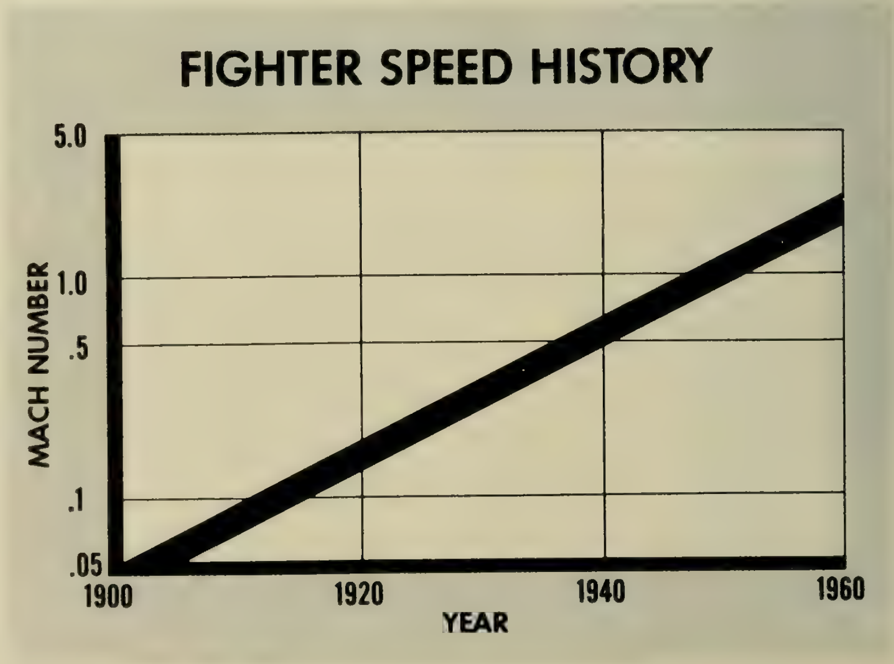


Figure 1

crowding you on one wing and Roscoe Turner is hunkered down on the other side. They're always the fastest starters and there you sit between them with nothing much for control, no acceleration and that horribly dry feeling in your mouth.

In a sense, you know you're lucky. You have a wonderful little airplane, but it's necessary to carry full nose down trim. That weight in the rear is going to cause some trouble. On the last race with only a little in the tank, only 15 gallons back there, the plane was hard to handle.

Half way down the field the stick is right up against the forward gas tank. You can feel the cold metal on your knuckles. Then you hit the first bad rut. There's no second throttle to straighten the plane. No brakes. Then the nose bounces up and the attitude is suddenly very steep but the tail skid is still dragging on the grass. You can feel the acceleration now and the end of the field is coming up fast. If you chop it . . . well, there's a thousand people milling around. You haven't got the guts to chop it. You've got to fly.

Okay, you do fly. Not the way you've been taught. Not the way you know an airplane should fly. This isn't a normal climb in any sense of the word. Talk about a homesick angel, this baby can qualify! The stick is still jammed full forward as you clear the crowd and suddenly the altimeter begins to wind around the dial like mad. At a thousand feet you begin to have a little play in the stick. You can get your knuckles clear of the forward gas tank and ease off a bit on that arm-killing pressure.

It's turbulent up here and the baby racer is bouncing like a chip. You can't control any of that with the stick though, and then you see the starting pylon and suddenly think of what a crazy business you're in and wonder if you shouldn't abandon the whole affair. The rest of the planes are disappearing in the haze up ahead and you make with the mental slide rule fast. "Let's see, 300 miles to go and maybe we've covered a half of a mile with the blind staggers. You shift tanks. Let's burn that lousy gas out of the rear. Then the first turn is coming up and you've got to make it, but there isn't any back pressure used in this turn. It's full ahead on the stick, and even then you almost stall the thing out.

Well, you make that first turn and finally complete the first lap, and then each time around the circuit gets a bit easier. Every trip around the pylons accounts for an additional couple of gallons of fuel, and by and by the CG begins to slide forward and in due time you have good control of the little monster.

So you're lucky, or maybe you're good. In any event, you're just a little luckier than the rest of the guys and you finally grind in ahead of 'em by a few whiskers and pick up the big dough. Of course you don't feel too elated until after you pop that galloping kite onto the ground. You're sure that old Roscoe slipped under you once and that meant he had lapped you around the course. You never considered the possibility of anyone but you having troubles. But you were wrong, everybody was having troubles that day and you were lucky to squeeze out a second place win.

Okay, briefly I've tried to put you in the seat of a midget airplane and fly a big-money race, for I feel now that maybe I can show you how we dreamed and designed and built and raced and sometimes didn't quite make the grade.

Very Thin Airfoils...
Some Sharp Leading Edges

To begin with, we took a tiny airplane and greatly extended the purpose for which it was designed. In other words, we took a midget and tried to compete with the big boys. Actually, it was mostly luck that we were successful. We packed in a tremendous amount of fuel and (this is important) we didn't do it right. This whole business could have turned out exactly opposite to the way we intended. Old Lady Luck was along and there isn't any other explanation. However, from such silly tricks as these we began to develop some know-how in the flying business. Weight and balance started to mean something, and our design people took every lesson to heart and later made them all work for us.

Back in 1941 I joined the Engineering Department of Lockheed. After years of barnstorming and racing I knew all the answers, and of course I really was a sizzling stone. It wasn't long until I could do impossible things with P-38s, and then one day when I least expected it, I got into compressibility. I was looking up at some trees when I got out of that dive, and it suddenly occured to me that maybe there were still a few unknowns in this flying business.

None of us like unknown factors. We're always a bit afraid of anything we don't understand, and so by trial and error we gradually learn the whys and wherefores of each problem as it appears and then after we know, we try to pass on the answers.

Jet Age

We thought we had most of the problems of flying licked after crowding every ounce of performance into reciprocating aircraft. Then along came the first jets. They really upset the applecart. Maximum performance for a piston driven plane suddenly became almost minimum performance for a jet, and as these speeds increased we ran up against something else . . . the sound barrier!

Starting with the experimental airplane, built by Bell, followed almost immediately by the F-80, the transition from reciprocating power to jet power was almost an overnight affair. The jet age was with us, and we were pretty much unprepared. Our thinking and our planning had to be altered radically. Even those of us who were in this new industry little realized where these blow-torches were leading us. We had a tiger by the tail, and it took a lot of doing to tame him.

In those early days, the combination of a jet airplane and a jet engine was considered to be the answer to almost every problem. I remember in particular a group of engineers waiting for me to make a test flight. One of the design men from an engine company said, "You know, our problems are over. The jet engine is so simple that we'll no longer have any great amount of trouble."

How wrong can a guy be?

The New Look

Then came 1949 and we entered the speed-nutty age. This business of cracking the sound barrier became a must for everybody in the business. If you hadn't cracked through, man, you hadn't lived!

I remember the first time I went through. Of course in those days you were on your own. We were all building aircraft with the same goal in mind, but at first nobody was passing out any free advice. Fortunately I had a good machine. It was well de-

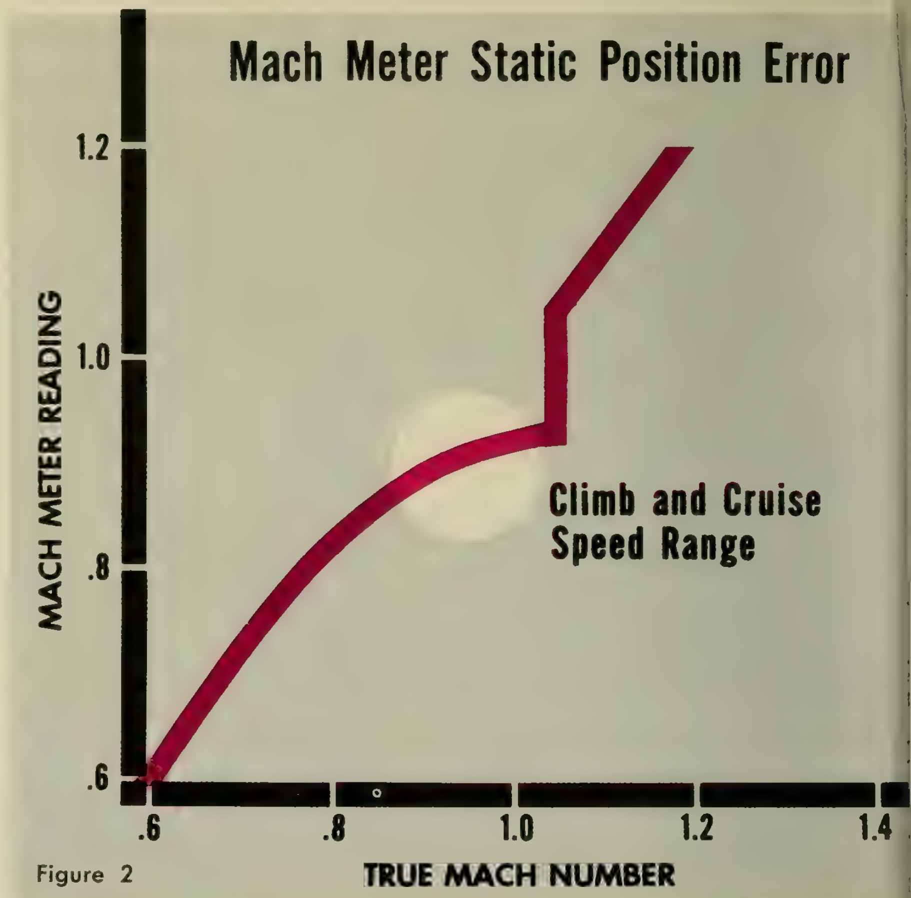
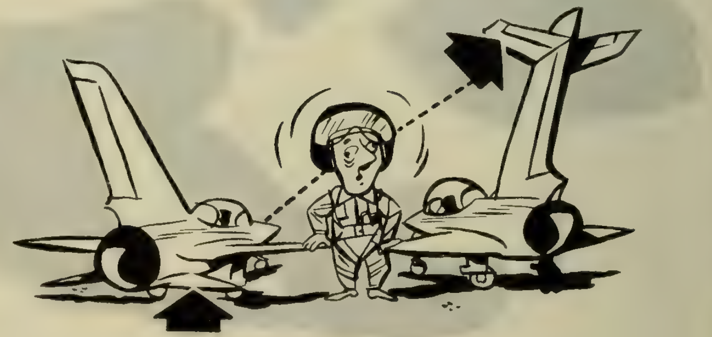
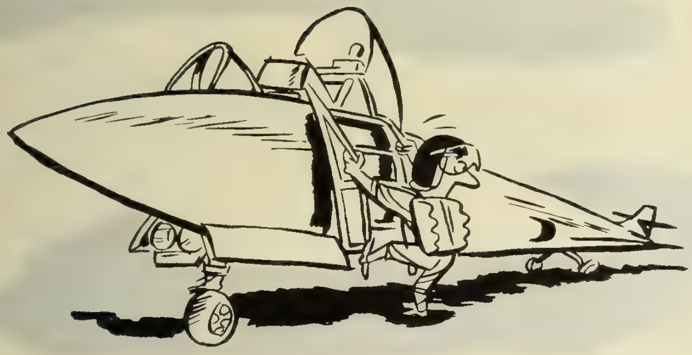


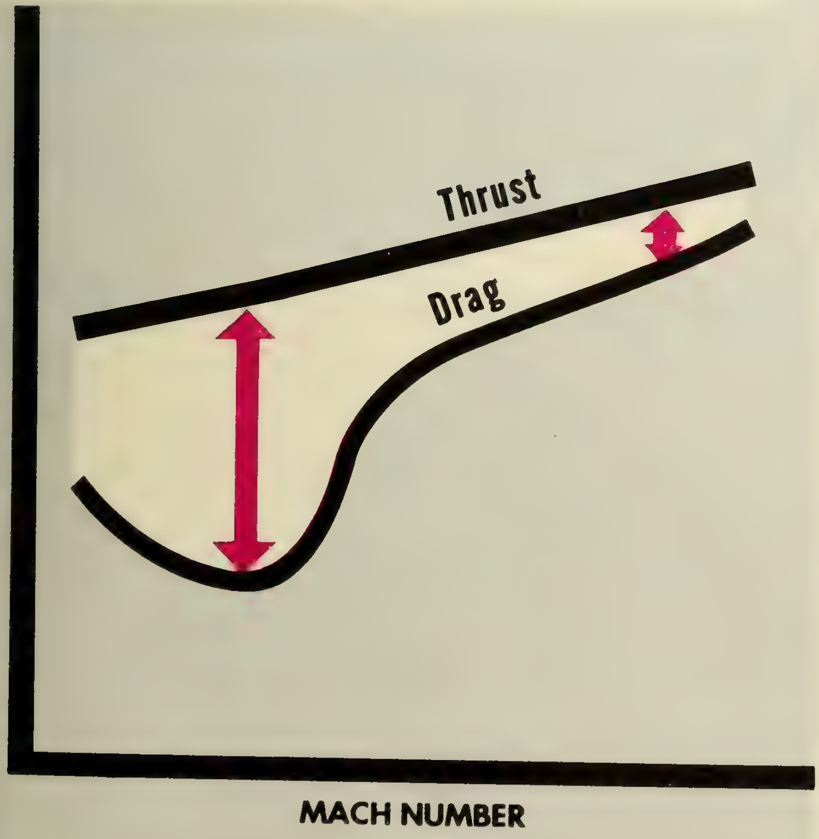
Figure 2



High or Low Horizontal Empennage Surfaces...None in Between



Longer Compared to Span ....



e 3

signed and well built. I didn't tear the wings or the tail off, and the plane and I both survived our first trip through the speed of sound. Now we've entered another new era. I call it *The New Look!* We've licked our old problems of sub-sonic speeds, only to be faced with new ones as we crowd across Mach. Our fighter planes have jumped into the 100 series, and the race is on again.

Airplanes today have a brand new appearance. You've seen most of them and once again you're asking, which configuration is best? We have deltas and swept wings and straight wings and some with almost no wings. If you'll look at Figure 1 you'll see what tremendous advances have been made in this speed business.

Back in 1903, the Wright Brothers' first airplane flew at 40 to 45 miles an hour. That's about .05 - .06 Mach. Now, if you'll follow the speed line on the graph, you'll see that we've doubled our speed every eight to ten years. By 1950 we had reached the sound barrier and were pressing against it in level flight. Then a peculiar thing happened. In the past two years we doubled the speed of sound and have gone through one barrier only to encounter another. We've accomplished as much, speedwise, in two years as we had accomplished previously by slow steps over a 50-year period, and the end is not yet in sight.

By 1960 we're going to be traveling awfully fast, and we've got to accelerate our thinking and planning once again to stay abreast of our advance into *The New Look.*

Now, let's take today. Right now, 1955. If you, as a pilot, should visit an Air Force test center, you'd find many different airplanes and a lot of strange and different configurations.

Every manufacturer is shooting toward more speed and better stability and control. Probably the outstanding difference in outward appearance of many new aircraft over the old, is the horizontal stabilizers. One may be extremely low. Another extremely high. In these super-sonic airplanes one may well wonder where it should be, but it probably won't be where it used to be, otherwise it would have been — and there you are!

Fuselage design too has changed a great deal. It used to be that the normal fuselage was about two thirds of the span of the wing. Now we find that most fuselages are twice the wing span and apparently still growing.

Our wing designs are changing radically too. Regardless of configuration, delta, swept or straight, each must be of low aspect ratio if they're to do the job. They've got to be razor sharp and razor thin. We have to forget such airfoil designs as the Clark Y and the Davis. They did a job, and a good one too, for slow airplanes, but today's wing in profile just doesn't resemble anything we've ever seen before.

Cockpit layout remains virtually unchanged in the supersonic airplane. Maybe it is improved a bit, but I feel that there is still room for refinement. One feature that is changing fast, however, is power over weight. Even though these new airplanes get bigger and heavier with every design change, the engine manufacturers are crowding ahead and making greater power available. This means, of course, that takeoff performance becomes increasingly better all the time.

As in all jets, altitude means miles when balanced against pounds of fuel consumed. To get that altitude we must climb on an exacting schedule, and right now it looks as though the best way to derive maximum climb performance is by utilizing the Mach meter as the gage, rather than the airspeed indicator.

Unfortunately, even the current Mach meter has certain limitations. This is known as static position error. Inasmuch as our newest aircraft climb and normally cruise in the subsonic range, it is unfortunate that this position error occurs right where we need it most. In reality, we're flying faster than the meter indicates and as speed increases, so too do drag and fuel consumption. Combat-wise, these new planes are critical as far as fuel is concerned. That is why I say we climb, cruise and let down on a definite schedule. As in any airplane, it'll do the job if the pilot is alert and careful. It's the careless lad who gets into trouble. That applies to any airplane ever invented.

A New Barrier

Another problem that faces us today is discovering the most economical power settings to insure maximum performance. This is a case of taking thrust and drag and working the two against a given Mach number for the greatest efficiency.

In the older jets, we found that the thrust line and the drag line usually met in the sub-sonic level and that, mind you, was with everything open. Throttle at 100 per cent and afterburner on. In these new birds, however, we find a different condition. We have low drag and high thrust — tremendous thrust. When we chart the performance, we find that the drag line rises quite sharply as we approach Mach, and then after passing through the barrier the drag line and the thrust line start to parallel each other and apparently continue on into infinity (see Figure 3).

As I noted previously, we're up against a new barrier now. It is the heat barrier. Call it thermal, if you prefer. Here our engines are running against a restriction of temperature, and eventually we may have to fly by a temperature gage when we get into the higher speeds. Okay, that's just another problem. We'll lick this one just as we've licked all of the other impossible problems in the past.

High Thrust to Weight Ratio...Rapid Acceleration

...Dives Get Real Hairy

We have to recognize today, more than ever before, that speed is energy. You store it up. The faster you go, the more energy is available and you can do a lot of things with it.

At altitude, indicated speeds may be low. Don't ever let that fool you because the true airspeed is high. And, you can use that speed in these supersonic jobs to a far greater advantage than you've ever imagined.

In the new fighter craft, you should remember that energy goes up by the square with increasing velocity, and from an altitude of 30,000 feet one may well zoom up to 60 or 70 thousand feet, if need be. Then, too, this stored up energy can be put to good use combat-wise, such as making complete turns without stalling instead of the usual 90-degree blind staggers that you've come to expect.

I'd like to inject a word of caution at this point, and I'm aiming it especially at you younger pilots. Take that tremendous amount of energy that you've stored up at 40,000 feet. It's great stuff and you can use it wisely or foolishly. Maybe you decide to drop down to the deck and shake up the troops. So, you split-S out. Well, in all probability that will be your last maneuver because your rate of closure with terra firma will be anywhere between 50,000 and 100,000 feet per minute! And, if that doesn't pop your eardrums a bit, I'll put in with you.

No Difference Before...or After

Back in the old P-38 days we used to have a Dutch Roll problem. This was the roll-yaw ratio deal, but fortunately the period was quite protracted and we could cope with it okay. Then came the jets and this oscillatory dynamic characteristic got a lot shorter, and finally came this new breed of cats and now the condition is about as short as a pilot can think. We know that our designers and engineers can dream up an airplane that will eliminate this oscillation factor, or dynamic characteristic, and like the rest of our problems, it eventually will be licked too. I bring this point out only to show you that *The New Look* is progressing steadily but a lot of spadework still remains.

Now as you all know, we speak of military aircraft as gun platforms. At least, we used to speak of all fighter planes that way. But today we call them weapons systems. Of course, I don't care what you call 'em as long as we remember that we're carrying guns to shoot down an enemy, and as such we have to consider the airplane as a part of the gun or guns.

Above all, any fighter airplane must have a great deal of basic stability. If, under certain conditions or within certain speed ranges, oscillatory factors are induced that upset this gun platform or weapons system, then we must have stability augmentors or rate dampers or other gadgets to prevent such oscillations, especially at critical moments.

You'll note that I use the word "gadget" when applied to rate dampers. Actually, that's what certain engineers call them, but if that terminology is correct, then I'll settle for calling fuel controls gadgets too, and you won't get off the ground today without a good fuel control system. By the same token, a good airplane, a good fighter plane, must have stability augmentors if we are to depend on it under all conditions of flight.

Radius of Action

Now let's consider another problem with our supersonic fighters. Maybe I'm using the word "problem" too often. Actually we have no more obstacles to think out and overcome in these new airplanes than in the old OX-5 Wacos. But this one concerns a basic radius of action problem. You're going to take your plane out

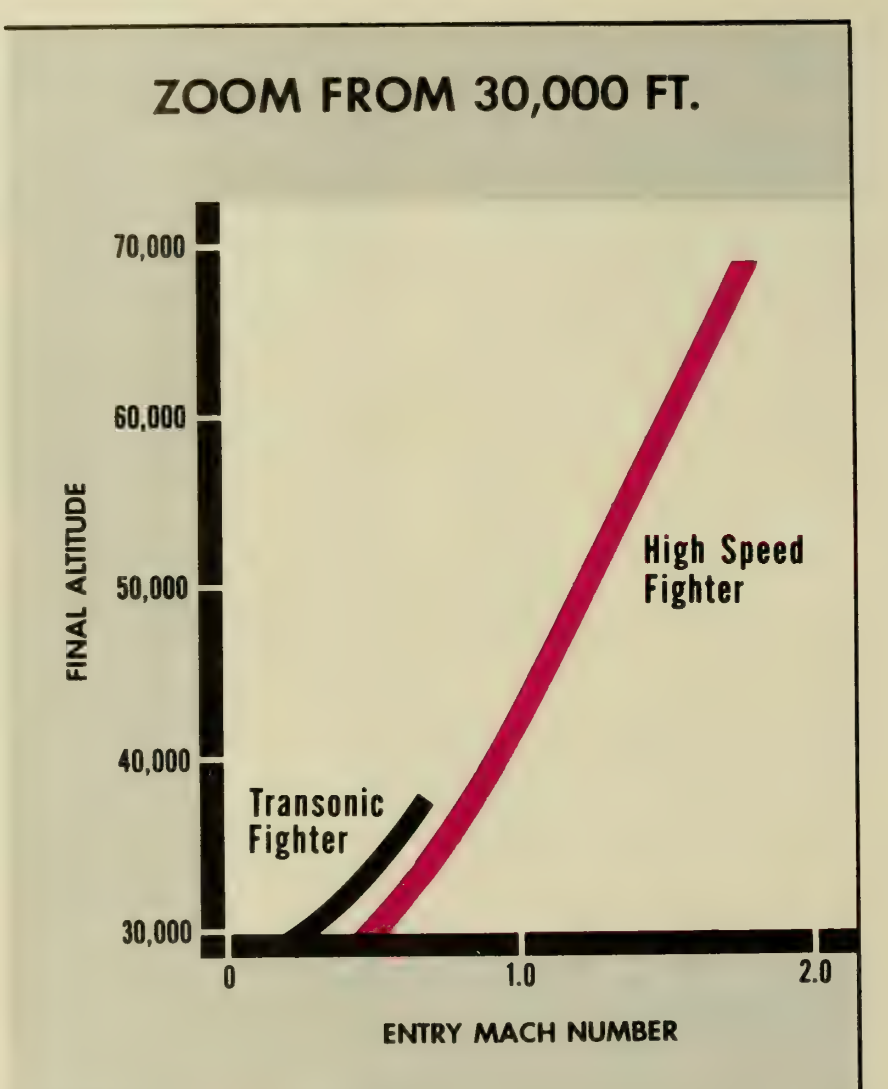


Figure 4

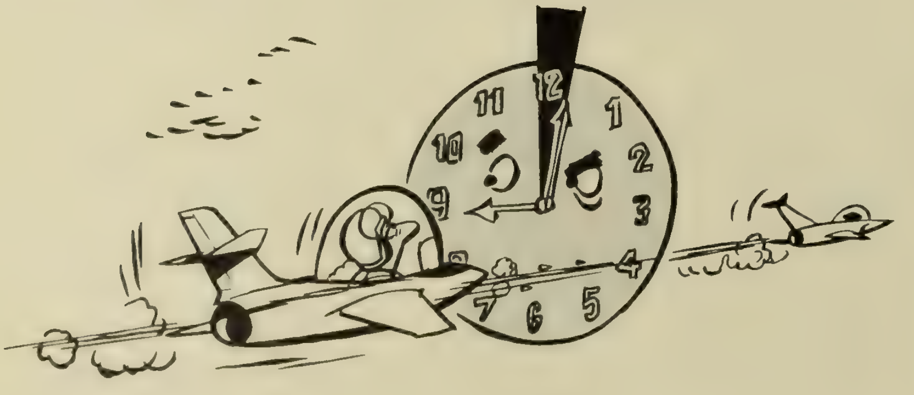
on a normal combat mission, possibly 250 miles from base, fight for five minutes at full bore and then return home. Of course procedures may vary a bit to suit conditions. Weather, tail-winds, cross-winds or other variables, but basically it's a routine chore.

Okay, you leap off, rendezvous with the rest of the flight upstairs and head on out. Somewhere out beyond the bomb line you tangle with the bogies. This is where you start figuring performance by a clock. You've got to know within a matter of seconds how long you can stay in the combat area, when you've got to break off and exactly how you'll fly the mission home.

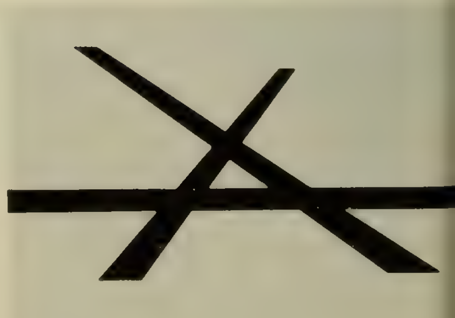
Possibly you'll have time for just one pass on a target. Maybe you'll have time for several. Remember though, you're flying at supersonic speeds now. I don't know how you pick up your targets. I imagine that the radar scope will assist. Then you lock-on to your objective. It's a head-on pass. You both miss (well, it can happen, you know), and you might as well figure that you won't see him again for at least two months.

Of course, there's always the chap who decides to turn and give chase. Bear in mind that I'm not belittling the merits of individual combat, but I know that the lone pilot who forgets the clock and bores away deep into enemy territory for five minutes or so after a fleeing adversary, just isn't going to make it back home.

We had the same problem in World War II and to a certain extent in the first war. The only basic difference today is the time element. We've got a lot less of that particular commodity now. Take three or four minutes of extra combat and you're going to use up 10 to 20 times as much fuel as in normal cruise. That's the ratio even though it's only rule-of-



Two Minutes More Combat Than Planned...
Can't Get Home



thumb. Just stick around too long and forget the clock and you'll be entering the traffic pattern on fumes instead of JP, if you're lucky enough to get that far.

Approach Technique

I've had a lot of people ask me about landing these new airplanes. They feel that anything that flies at supersonic speed must be a scarey brute to plunk onto the deck. 'Taint so. Actually they're easy to land if you know the rudiments of flying and reduce the handbooks to facts. You should talk with people who know the ropes and get to know every system of the plane before you leap off.

I sincerely believe that any 400 to 500-hour military pilot who has grown up with jets can fly these new craft safely and efficiently. You've got to be led properly and taught properly and clued-in on the few factors that must be watched. Like the old railroad slogan, you've got to stop, look and listen before you can start. Do that, and you've got it made.

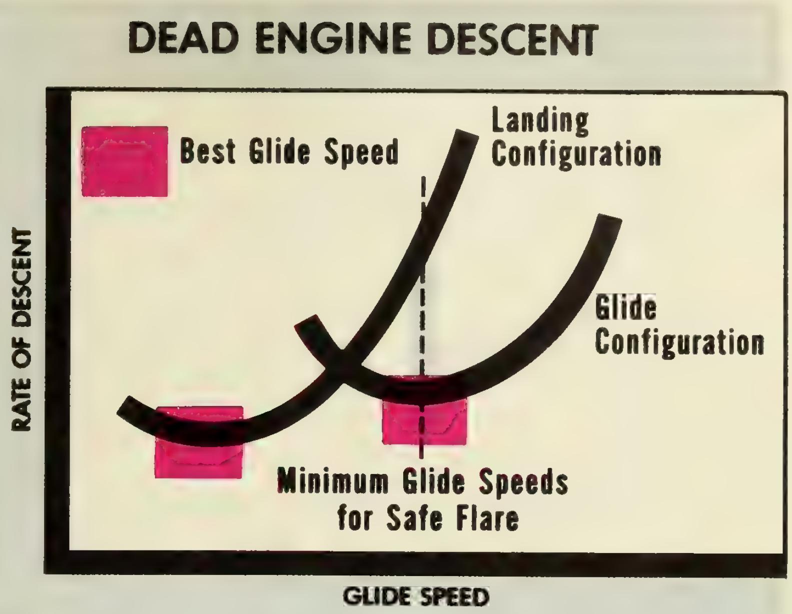


Figure 5

Years ago when I flew my first jet I recognized the fact that here was no ordinary airplane. I tried to convey my beliefs into the original handbooks that I helped to write. Even the best of pilots have failed to recognize some of the jet shortcomings, at first. When you were coming in for a landing and suddenly realized that an undershoot was becoming a reality, you poured on the coal and got exactly nothing. Engine acceleration time was anywhere from 15 to even 20 seconds. A few times I've had a lousy fuel control hang me up for as long as a minute. Things have changed a lot since then, but we must not forget the early lessons.

Fuel controls are much better today and the engines are better, but believe me they're still not good enough to come in on a normal ap-

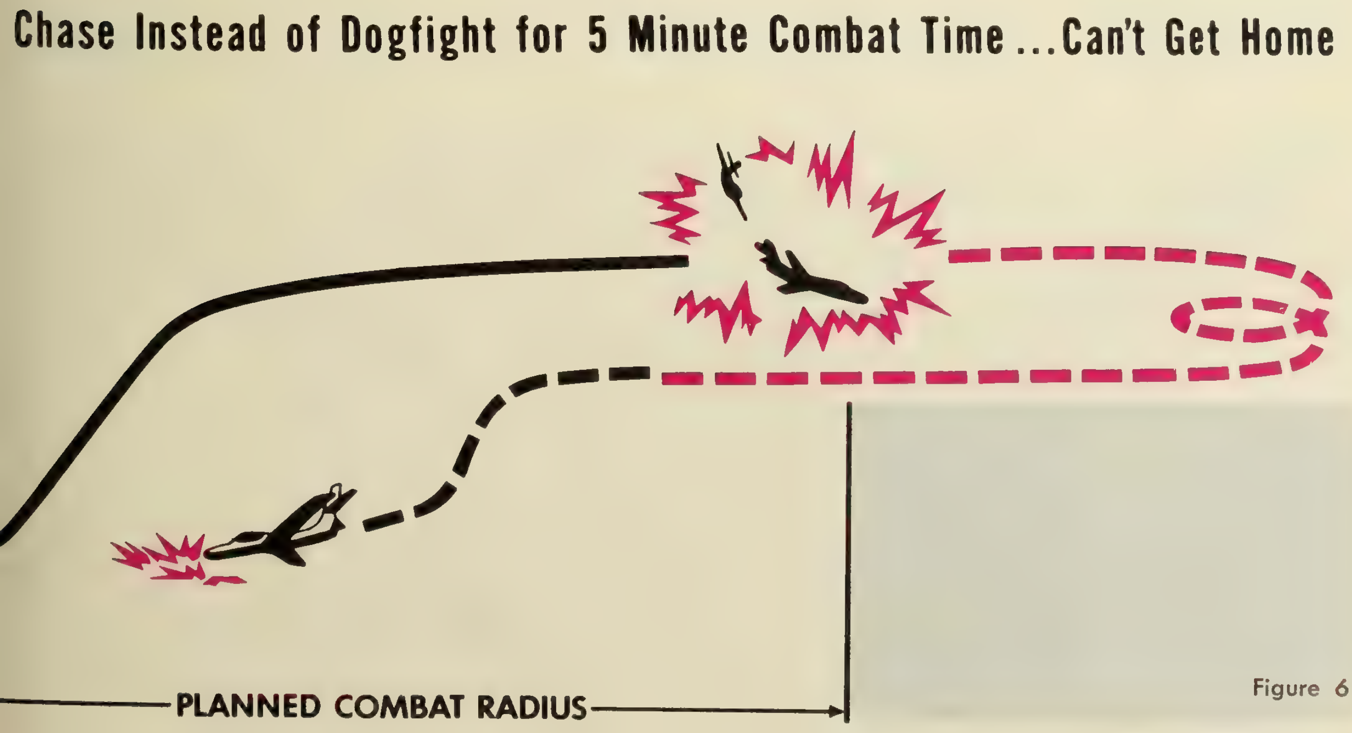
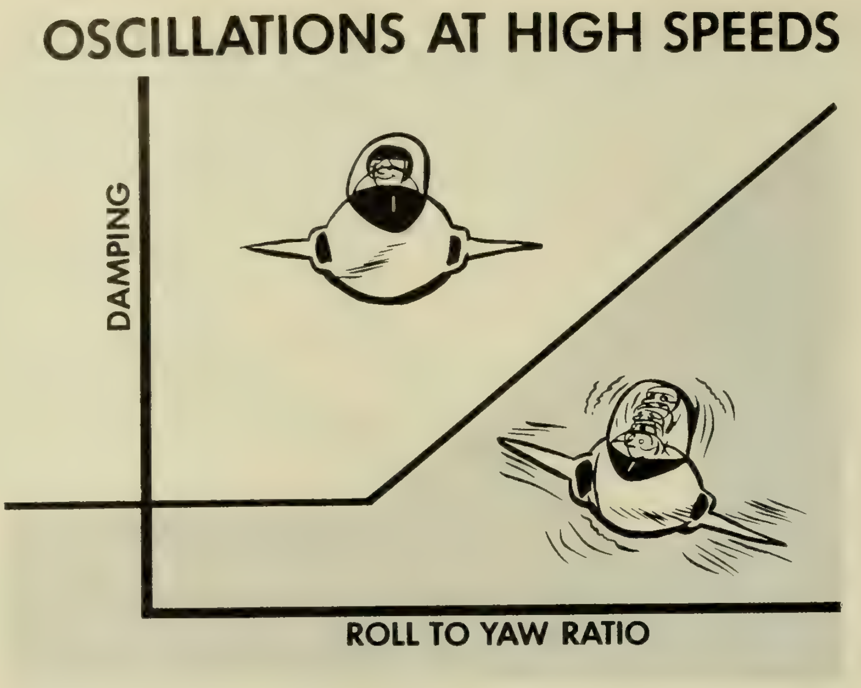

Chase Instead of Dogfight for 5 Minute Combat Time ... Can't Get Home
PLANNED COMBAT RADIUS

Figure 6



proach, chop the throttle and still have instantaneous power, if you suddenly need it.

Just for the sake of discussion, let's say that you have been out on a two-hour combat mission. You come back intact, arrive over the base with 800 pounds of fuel, maybe 400 pounds, but no matter. If you've enough fuel remaining for one minute, you have it hacked. That's all your approach will take. Just one minute. Then at this point you get a little careless. You figure that you'll chop the throttle and save as much fuel as possible. You say to yourself, "I've got to make this approach with the throttle in idle because the engine might flame out."

Well, maybe it will, but it kept grinding along while you were deep in enemy territory and it brought you home and there's still a few pounds of fuel left, so the odds are that it'll keep on running until you're in.

What I'm really getting at is this. Take a good look at Figure 7. You chop that throttle all the way back in your supersonic fighter and, brother, you probably won't make it. In a nutshell, you'll prang short. Note that I say prang, not land. If on the other hand you carry a wee bit of power and then see you're not going to make the runway, chances are against your making it even if you do slam it into full bore. Know why? Your reaction time is about 17 jumps behind the airplane. But if you carry plenty of power for the particular configuration and make a standard power-on approach, then you'll have it made with no sweat.

Still discussing our newest airplanes, there are certain factors that are different from any of our previous models and types. As noted before, every supersonic plane is, of necessity, one of low aspect ratio and when you get an aircraft of this type down in the lower speed ranges, such as are necessary for approaches and landings, there is a tremendous amount of drag evidenced, even if the gear and flaps are not down. Now, if we lose an engine because of combat damage or other factors, then we have to be thoroughly conversant with dead engine descent procedures. Right now, that's where we come into the picture.

If you'll study Figure 5, you will see two curves. In essence they do appear similar but there is one out-

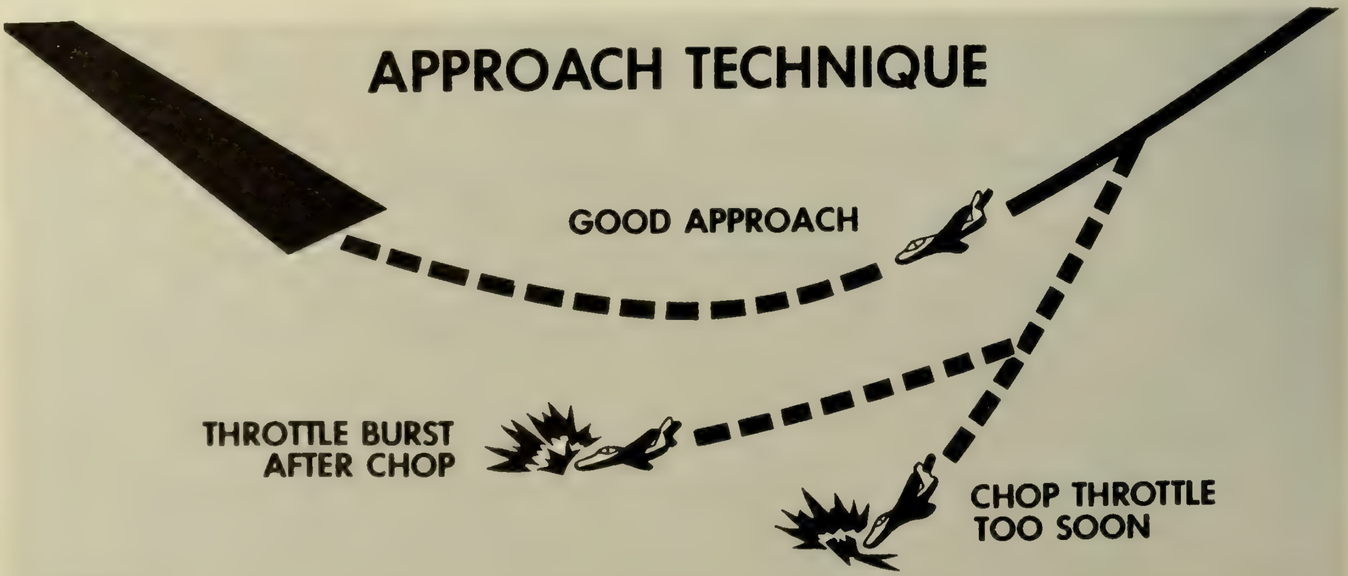


Figure 7

standing difference. The one on the left is plotted for landing configuration while that on the right is for a clean airplane.

In plotting these things, our engineers have to consider two factors: rate of descent and glide speed. What we're trying to find is a minimum speed for the least amount of sink. In other words, it's a case of lift over drag (L/D). Such curves as these are accurate. I know, for I've flown 'em all. However, this particular one on the left would curl your hair and after I'd fooled with it for entirely too long, I decided I'd best get with the slide rule boys and try some brand new tactics.

As an individual I like speed. The longer I flew these plotted glide curves, the more certain I became that if we moved back up the left curve a bit, we'd be better off. In essence, more speed spelled better control to me. Although the engineers had figured these curves for optimum efficiency, i.e., lowest sink for minimum maneuvering speed, the fact still remained that this didn't feel good. There was nothing left to play with. No surplus speed, or kinetic energy to juggle when flight conditions were not completely static. So, I elected to give more glide speed a bit of a whirl.

Somehow that didn't work out either. It gets extremely disconcerting when one looks out through the top of the canopy and sees the landing strip and that rate of sink was out of this world. I've seen bricks fall slower. I wonder who called all this a glide? Anyway I finally decided the curve on the right might be the answer if we could just solve a few small problems.

First was the matter of flaring out properly. Possibly 1500 feet would be a bit too high and then too, 500 feet could well be too low. This was a hard one to solve (remember, I don't have any greater error margin allotted to me than you have) and then the thought occurred that if we could design a quick, free-fall gear, possibly our second problem (gear not down) would automatically solve the first problem too.

Somewhere along the line there's always a solution to these things. Now we have to acknowledge that speed means better control. We need speed for our approach, for starting the flare, for whatever little bit of jockeying is necessary and for good control on the touchdown. So, somewhere in here we've got to get the gear down but not so soon as to build up a lot of drag and louse up that L/D factor prematurely.

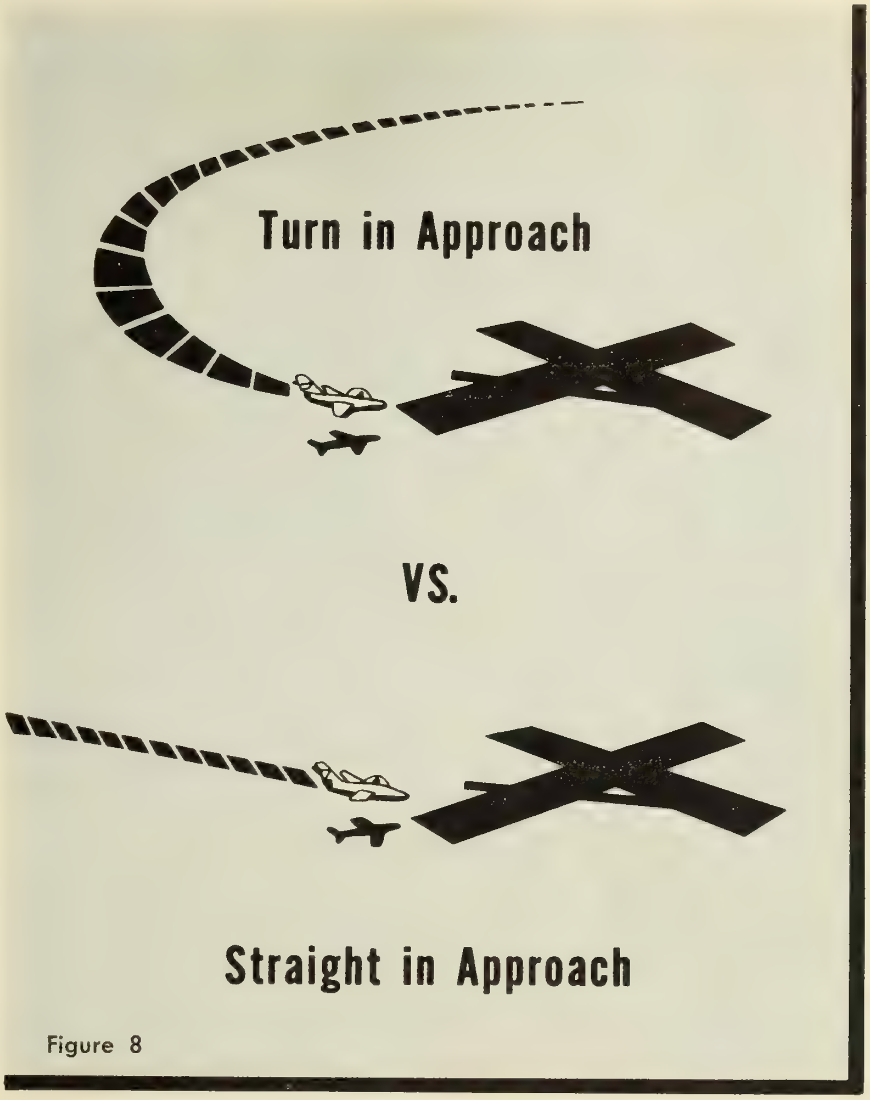


Figure 8

Another bet that has been overlooked by some quarters is the possibility of establishing some optimum flap settings. There's no reason why we have to put flaps down and leave them there. Just as easily we could work out varying flap settings for various configurations that could be applied as needed at different points along the glide path and still take advantage of every bit of energy to derive maximum efficiency from our plane. These are factors that weren't worked out overnight. We don't have a magic wand but like the rest of our problems from years past, we're slowly building up our know-how.

I am firmly convinced that we're going to have to revise our flameout patterns for the supersonic jobs. The tried and true high and low key positions just won't work out in the new babies. With a dead mill, rolling into a gliding turn increases the rate of sink all out of proportion to anything you've ever experienced. We're going to have to establish aiming points for a straight-in approach, practice for proper flaring and plan a good many miles ahead of the airplane. Actually, it won't be any more difficult than our present flameout patterns, after one gets the hang of it.

Well, there you have it. Maybe I've rambled about a bit. We're entering the supersonic age though and sometimes we have to look back a little in order to see ahead. ●

round trip

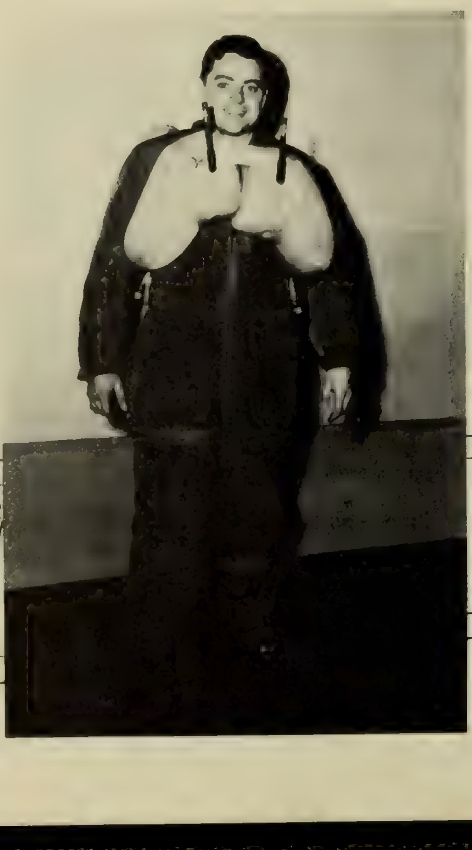
THE SETTING is on the flight line of a southern base on a typical day in mid-November. The temperature is in the mid-60s. Under the wing of one of our sleek bombers, we find the crew preparing for a 15-hour mission. The trio is meticulous in its actions as last minute preparations are made for the flight. Their final action before boarding the aircraft is to dress for the occasion. This takes from five to eight minutes. Although the amount of clothing is somewhat more than that required for other types of flying, it must be remembered that climatic equipment cannot be put on under emergency conditions but must be ready for immediate use in the event of such emergency.

The innermost garment is a partial pressure suit which is available in case the pressurized cabins become damaged. This suit operates on the principle of applying counter pressure in amounts equal to the breathing pressure. There is a seal at the neck and oxygen in the helmet or in the mask, depending upon which type of helmet is used.

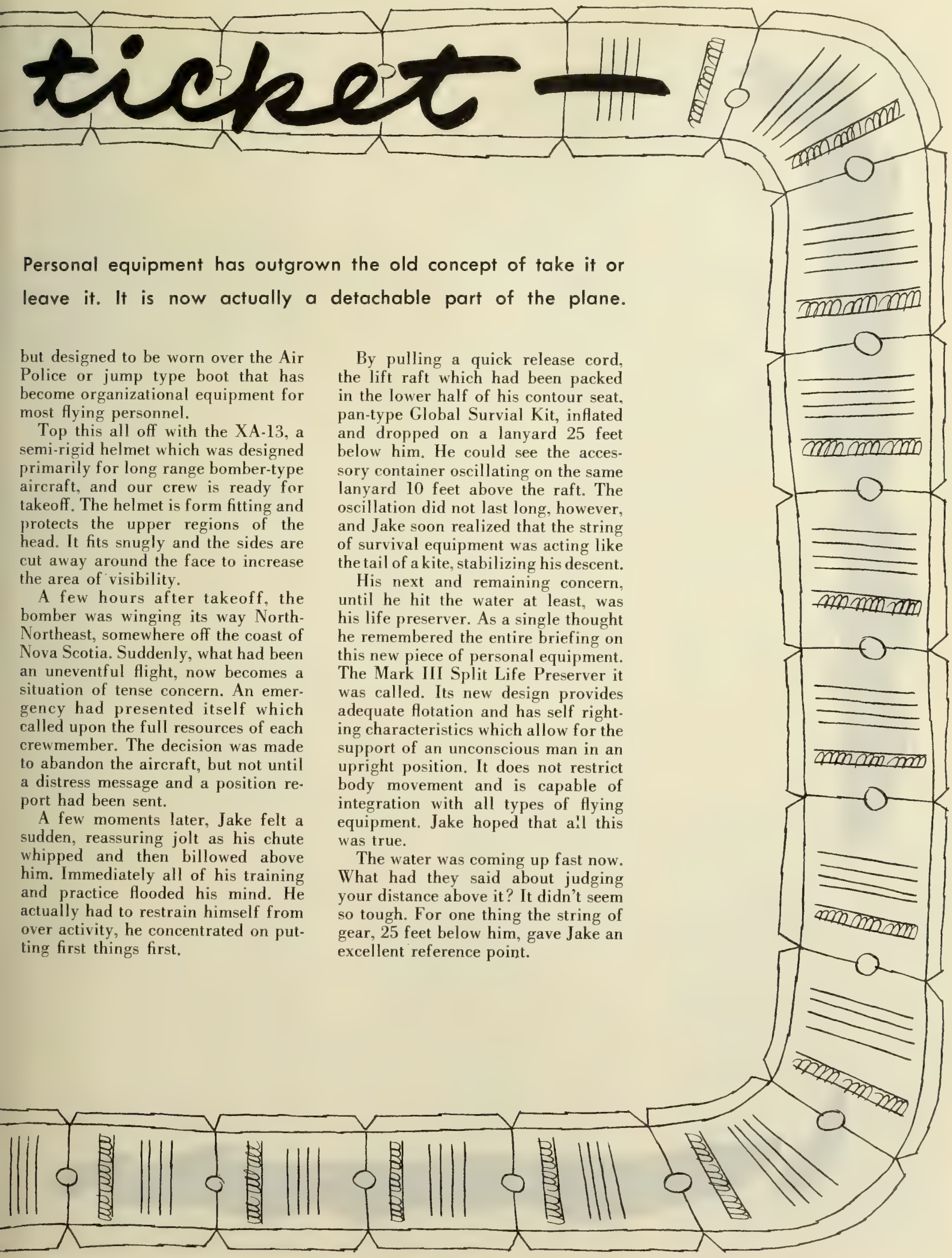
The suit is provided with both an aneroid release, set to go into operation at a predetermined altitude and a manual mechanism for inflation in the event of aneroid failure. The development of the pressure suit has cost approximately $1,500,000, and is estimated to have saved over $15,000.000 worth of aircraft.

The second garment is a ventilated suit which keeps the man in thermal balance with cockpit temperatures up to 140° F. This suit is designed for connection with the aircraft air conditioning system or for use with a blower-type device. It is a double layer, apron-type garment made of neoprene nylon material and weighs approximately 12 ounces. Future plans are to develop this suit with an individual lead which will provide for individual thermostatic control whether the crews are over the Arctic or over the Tropics.

The next article of clothing is a winter flying suit or liner for the outer exposure suit. The last and outer garment also is impregnated with neoprene and is put on through an extended V-opening or a slant-cut opening, depending upon the model. The important features of these suits are the inner seals at the neck and sleeves which insure waterproof protection. Completing the outfit is a pair of rubber boots, not insulated,



Designed for the upright support of an unconscious man, the Mark III resembles a pair of water wings.



ticket —

Personal equipment has outgrown the old concept of take it or leave it. It is now actually a detachable part of the plane.

but designed to be worn over the Air Police or jump type boot that has become organizational equipment for most flying personnel.

Top this all off with the XA-13, a semi-rigid helmet which was designed primarily for long range bomber-type aircraft, and our crew is ready for takeoff. The helmet is form fitting and protects the upper regions of the head. It fits snugly and the sides are cut away around the face to increase the area of visibility.

A few hours after takeoff, the bomber was winging its way North-Northeast, somewhere off the coast of Nova Scotia. Suddenly, what had been an uneventful flight, now becomes a situation of tense concern. An emergency had presented itself which called upon the full resources of each crewmember. The decision was made to abandon the aircraft, but not until a distress message and a position report had been sent.

A few moments later, Jake felt a sudden, reassuring jolt as his chute whipped and then billowed above him. Immediately all of his training and practice flooded his mind. He actually had to restrain himself from over activity, he concentrated on putting first things first.

By pulling a quick release cord, the lift raft which had been packed in the lower half of his contour seat, pan-type Global Survial Kit, inflated and dropped on a lanyard 25 feet below him. He could see the accessory container oscillating on the same lanyard 10 feet above the raft. The oscillation did not last long, however, and Jake soon realized that the string of survival equipment was acting like the tail of a kite, stabilizing his descent.

His next and remaining concern, until he hit the water at least, was his life preserver. As a single thought he remembered the entire briefing on this new piece of personal equipment. The Mark III Split Life Preserver it was called. Its new design provides adequate flotation and has self righting characteristics which allow for the support of an unconscious man in an upright position. It does not restrict body movement and is capable of integration with all types of flying equipment. Jake hoped that all this was true.

The water was coming up fast now. What had they said about judging your distance above it? It didn't seem so tough. For one thing the string of gear, 25 feet below him, gave Jake an excellent reference point.

The brilliant yellow life raft seemed to be suspended momentarily in mid-air, almost as if it were taking a final breath before plunging into the dark, frigid waters of the North Atlantic. In quick succession came the accessory container, the pilot, and last, the billowing 24-foot canopy. All became part of the wind-swept sea.

As Jake's feet touched the water, he instinctively slipped out of his chute harness and inflated his life preserver. He had often wondered how he would react if this time ever came. Here he was, going through procedures as methodically as if he were rehearsing back at the base swimming pool. Even in the face of this crisis, he was unconsciously aware of the strange sensation of mildly cold pressures enveloping his body instead of the freezing, soaking, wetness that his reflexes were mentally prepared for.

With these impressions fleeting through his mind, his next thought was to locate the life raft. Although the sea rose in great swells all about him, the Mark III held his head high and clear of the churning waters, defeating the sea's first line of attack.

It seemed to him as though he was bobbing around in a deep canyon, looking up at huge, green, white-crested mountains that swelled endlessly and diminished on all sides of him. His raft was nowhere in sight but a constant tugging about his middle reminded him that it was somewhere within 25 feet of him and ready for occupancy.

As he hauled on the lanyard that assured him of his flotation gear, Jake realized for the first time that his hands and face were almost numb with cold. The bitter numbing cold that inevitably subdues all struggle for survival. However, this same cold did not penetrate the rest of his body. Exposure, the sea's slower but deadly secondary line of attack was failing. He lashed out for the tugging life raft with a new fury.

As he lay completely exhausted in the raft, Jake became accustomed to the violent pitching and rolling motion caused by the heaving waters. When deep in the valleys, his world of green seemed to completely envelop him. It even seemed to offer warmth and seclusion from the biting wind. When momentarily riding the ridge of his green mountains, he could glimpse the entire span of restless ocean. Mentally he played a game of hide and seek with the other two bright yellow dots. Sometimes he could see them both at once, while at other times one or both were completely out of sight.

While still engaged in his mental gymnastics, Jake suddenly saw a third player in his game. The impact of the new participant hit him all at once! It couldn't be, not this soon, but there it was, a cutter's prow knifing through the mountainous swells and headed directly for them.

He was thankful that time had permitted the sending of a distress message and a position report before they abandoned the aircraft.

Although the foregoing series of events were purely fictional, the equipment worn and utilized by the mythical crew is the real thing. The facts concerning the articles of survival were presented by the Aero-Med briefing team from the Wright Air Development Center. The occasion was a recent program sponsored by the Air Force Operational Test Center at Eglin AFB, Florida.

Just what do the Jakes and Johns who make up an Air Force aircrew need to survive mishaps in this day and age of high altitude and round-the-world flight? This question and many others were answered by the Aero-Meds.

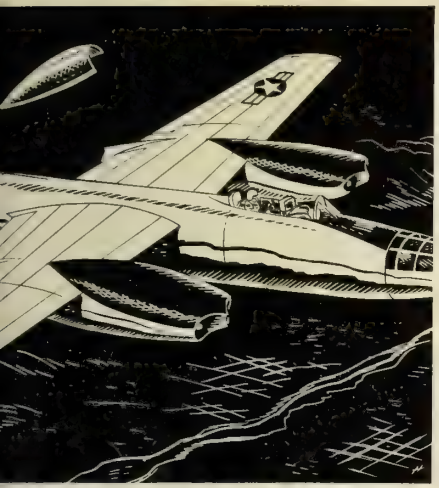
The actual briefings at Eglin AFB were conducted by Captain William C. Kaufman, project engineer for emergency high altitude suits in the Respiration Center, and Lt. Billy J. Mills, project engineer in the Integration Section of the Aero Medical Laboratory, WADC. The briefing covered the present and proposed types of survival equipment which are required in this era when the capability of the Air Force to carry out its mission depends upon the air crews whose capabilities are directly dependent upon their personal, emergency and survival equipment.

This preview of the actual and proposed revisions in survival equipment should reassure each air crewmember that protection in flight has progressed hand in hand with flight. Although the equipment has changed, there is still one determining factor as to its success or failure that has not — *You*. No matter how fool-proof the device may be, it's still up to the crewmember to use it properly.

Records indicate all too many instances where survival would have been assured had the available equipment been used correctly or even used. Personal equipment has outgrown the old concept of take it or leave it. It is now actually a detachable part of the airplane. Although the airplane will fly without these parts, a smart pilot would not. ●

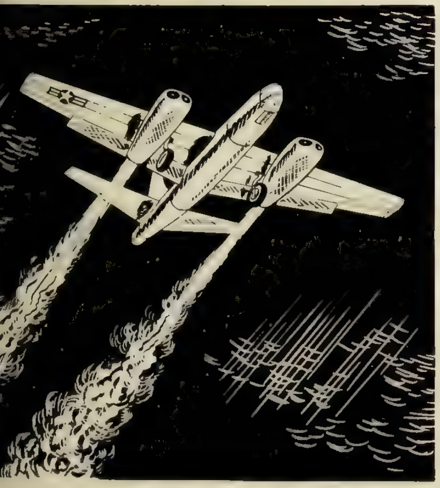
Eight minutes are required to completely garb today's crewmember for high altitude flight.

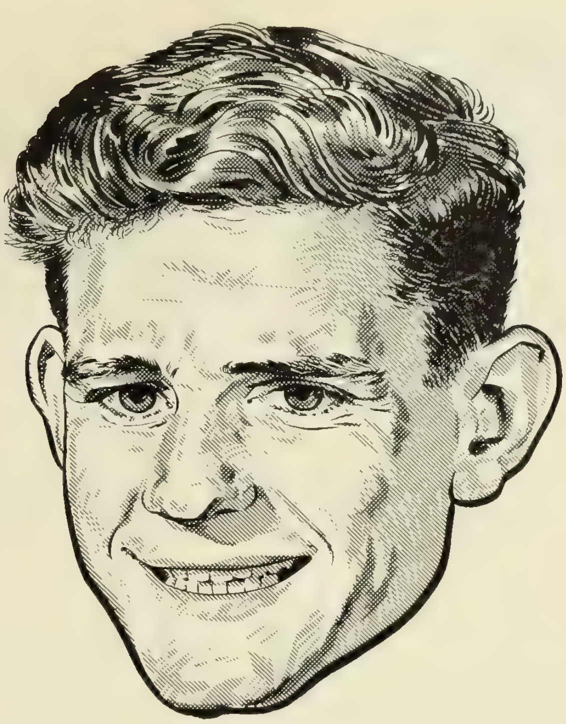
The XA-13, a semi-rigid helmet, designed primarily for the long-range bomber aircraft.



As the aircraft passed through 24,000 feet, the canopy blew off and struck the pilot on the head. He slumped forward, unconscious, greatly restricting any movement of the aircraft's controls.

On Lt. Rowley's first landing attempt, the pilot partially regained consciousness and involuntarily pushed the throttle forward. A go-around had to be made because of the excessive airspeed.





WELL DONE

2d Lt. Donald J. Rowley

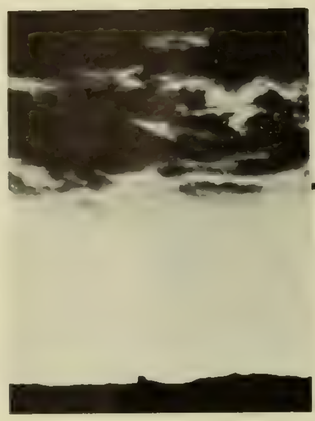
Flight Test Maint. Officer, Hq SBAMA, Norton AFB, Calif.

LT. DONALD J. ROWLEY was the copilot on a B-45 test flight. He had climbed to 10,000 feet and had flown at this altitude for some time when the pilot instructed him to climb to 25,000. As the aircraft passed through the 24,000-foot level, the canopy blew off, and struck the pilot on the head, rendering him unconscious.

Although Lt. Rowley had a total of only three and one-half hours in a B-45 and had never landed the aircraft, he elected to attempt a normal gear down landing from the rear seat. He was confronted with the serious problems of no forward visibility, extreme wind velocity, freezing temperature, no engine instruments and no flaps or brakes. The unconscious pilot had slumped forward, restricting control movement; however, the crew chief was able to crawl aft, pull the pilot away from the controls and lower the landing gear.

The first landing attempt was unsuccessful because the pilot partially regained consciousness and involuntarily pushed the throttles forward, but a successful go-around was made. On the next attempt, Lt. Rowley was able to complete the landing by skidding the aircraft from side to side on the final to catch momentary glimpses of the runway, and he stopped the aircraft by use of the emergency brake system.

Lt. Rowley's devotion to duty and his exceptional skill and courage are a credit to himself and the U. S. Air Force. Well Done!



Some of the very worst flying conditions are encountered in the vicinity of squall lines.

FELLOW TRAVELERS

Major W. B. Willis, Hdq, Air Weather Service

SQUALL LINES and tornadoes occur under similar conditions. Tornadoes may occur at any time within the formative stage of squall lines; or they may form during, in advance or to the rear of a squall line. They also occur frequently when there is no identifiable squall line.

It goes without saying that some of the worst flying conditions are encountered in the vicinity of squall lines. This is true because in their most active stage, during their first few hours of life, they are composed of a continuous line of thunderstorms containing moderate to severe turbulence, heavy rain or hail, almost continuous lightning, gusty winds, brief windshifts, rapid temperature falls and abrupt pressure rises. There is always the possibility of one or more tornadoes in the vicinity of a squall line.

A tornado is a violent circular whirlpool of air, having an average diameter of 250 yards. Within its funnel-shaped cloud there are spiraling winds of terrific speed. Estimates of this speed vary from 200 to 600 mph.

Tornadoes usually move from southwest to northeast at approximately 40 mph but have a tendency to skip about at random along their general course. No one yet knows how high the funnel cloud of the tornado extends above the base of the thunderstorm under which it forms, but tornadic influence has been encountered at nearly 40,000 feet. A funnel-shaped cloud was reported in one instance as extending from the surface of the earth to approximately 35,000 feet where it merged with the cirrus anvil overhanging clouds. Lightning, in a thunderstorm containing a tornado, is the bright continuous sheet type with a lacework effect due to intensely vivid flashes of frequent forked lightning. It appears brighter, more colorful and more vicious than in any other type of storm. Although it is one of the least extensive, a tornado is the most violent of all storms.

The life span of a tornado is exceptionally short, approximately one hour for the average storm. The life span of the squall line is relatively short also, usually 12 hours.

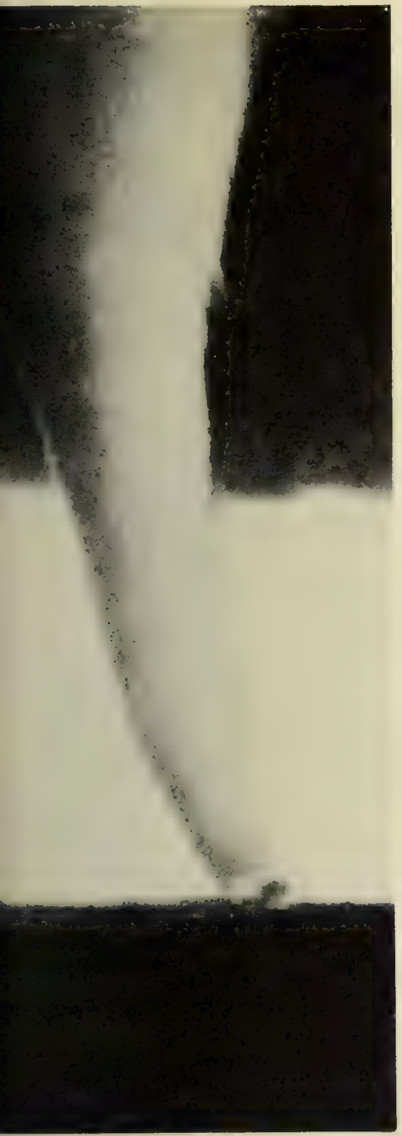
The Severe Weather Warning Center of the Air Weather Service attempts to forecast the geographical areas and times of occurrence of tornadoes, as well as hail, severe turbulence aloft and gusty surface winds in excess of 50 knots associated with severe thunderstorms.

At the present time the geographical area, within which the most intense thunderstorms are expected to occur, is referred to in teletype messages as a "black area." Within this black area there may be forecast areas of tornadoes. These areas will be restricted to 10,000 square miles if possible, but may be larger if the developing weather warrants it. This is an advisory service and the information is sent directly to the station weather officers and flight service centers for further dissemination. At the present time the information furnished by the Severe Weather Warning Center is not available through CAA Radio Range Stations.

Squall lines are rather difficult to forecast by even the most experienced personnel. In some instances they are well past the formative stage before they are identified on map analysis by forecasting personnel and seldom if ever appear on 24 or 36-hour forecast maps. Thus, if a squall line forms over a rather sparsely settled area, it may be in its most active stage before it is identified.

Every pilot who was ever caught in a squall line would probably have given most anything he had to have been warned in advance. Until there is a better understanding of the mechanism of squall lines, the best method of dealing with the problem is to recognize them as soon as pos-

The tornado, a violent whirlpool of air, may often be associated with embryo squall lines.



High, spiraling winds of the tornado often reach velocities of from 200 to 600 mph.

sible after they have formed. Almost any cold front situation may be a squall line breeder.

Tornadoes are equally as difficult to forecast. To predict exactly where one will strike, with any degree of accuracy, is virtually impossible. The Severe Weather Warning Advisory has proven to be of valuable service to flights through black areas. Pilots are more cautious and keep a closer watch on weather conditions than they are prone to do normally.

Atmospheric instability is prevalent over most of the United States east of the Rockies, with normally a steady progression of cold fronts and accompanying squall lines from March through June. This is also the period in which to expect a sharp increase in tornado activity, with the area of maximum occurrence, approximately 600 miles in diameter, centered over northwestern Mississippi in March. This area moves northwestward through April and is centered over eastern Kansas in May and June, with the belt of maximum occurrence extending from northern Oklahoma to southern Minnesota.

Having an average diameter of 250 yards, tornadoes often extend from the surface of the ground to great heights within the squall line. Their influence has been felt up to 35,000 feet.

Records from 1916 through 1954 indicate that half of the reported tornadoes occurred between 1400 and 2000 local time, and that approximately 80 per cent of the total occurred between noon and midnight. They have been reported at all hours of the day and night throughout every month of the year.

Studies of squall lines and flights through them, indicate no apparent preferred level for penetrating a given severe squall line. Severe turbulence has been reported at all levels flown and from 4000 feet up; there seems to be no one level worse than another. More severe turbulence reports were received between 2000 and 4000 feet than for any of the other levels, but it is thought that this was due to the belief of many pilots that they were less likely to encounter severe turbulence in the lower levels.

Radar is an excellent aid in determining the location of squall lines. However, it only indicates areas of precipitation and many pilots have had the mistaken idea that if they can avoid these areas they will be clear of all severe turbulence. This is only partially true because a radar echo does not in itself indicate turbulence and there have been numerous occurrences of turbulence outside of cloud and rain areas.

Very few people have flown into a tornado and lived to tell of their experience. (See *Flying Safety Magazine,* July 1954). It is the opinion of those who have flown through one that it is impossible for any pilot, regardless of experience level, to fly safely through tornado areas without being subjected to extremely hazardous conditions.

There is really no comfortable level for penetrating violent thunderstorm activity, such as is encountered in severe squall lines, with the types of airplanes being flown today.

On many different occasions experienced pilots, with thousands of flying hours to their credit, have been unable to get their aircraft successfully through a squall line area. This is true for both commercial and military pilots.

It is absolutely true that most thunderstorms in their dissipating stage can be flown through with only light or moderate turbulence being encountered. Obviously, it is foolish to fly deliberately through squall lines or well-developed thunderstorms that appear to be in their most active stage.

Air Weather Service personnel are available to give you the latest actual and forecast weather conditions for your proposed flight. They, in turn, would appreciate your report of any unusual activity or deviation from forecast weather. Call the nearest radio facility and give them the information as soon as possible, and at your first stop give the local weather forecaster a thorough briefing. Your information might mean a lot to another pilot who will be flying along the same route. ●

YOU - SAFE CO-OP

Above, approved checklists and emergency procedures were lumped into a usable package.

Presented here is a new approach to a command-wide, Flying Safety program anchored by Headquarters at one end and operational personnel at the other.

The following article outlines the efforts of Headquarters United States Air Forces in Europe toward the aircraft accident prevention problem. It serves to stress the fact that major commands realize their responsibilities in accident prevention, and that they don't expect the pilot to "go it alone." Their program reflects the attitude that USAFE pilots can shoot holes in the accident rate only if provided with the ammunition.

"DRASTICALLY Reduce the Aircraft Accident Rate." That is the USAFE battle cry. True, the cry is an old one . . but the approach isn't.

The new approach, originated in early 1954, and has proved to be a definite step in the right direction. It was based on the logical formula of integrating the operation and inspection functions into a homogeneous effort. The program was built upon a command-wide organization anchored at one end by staff specialists in Headquarters and at the other end by the men in the operational units.

The foundation of the organization was standardization and education. With these tenets in mind, reorganization was accomplished at USAFE level to include Flight Safety as a Directorate of the Inspector General and a Standardization Board under the Deputy Chief of Staff for Operations. This structure enabled Flight Safety to assimilate inspection data and to scrutinize the efforts on all staff functions with impunity. The Standardization Board centered its activities around achieving maximum utilization, efficiency and combat capability of command resources.

At the same time, Standardization Officers were appointed at operating levels to work in close cooperation with the unit Flight Safety Officers. Headquarters USAFE issued directives to these levels establishing methods of operation.

Officers in the Directorate of Flight Safety and specialists from the Standardization Board participate jointly in formulating command policies and procedures for USAFE-wide dissemination.

The Standardization Board's first efforts were directed toward focusing attention on standardization in such a manner that it was no longer the result of individual efforts but an overall command contribution. Standardization was based on proven practices, procedures and techniques, not on the deep rooted dogma of "Here is the way I've always done it." These approved standards were lumped into usable packages in the form of manuals on standard operating procedures, emergency procedures, checklists and standard aircrew flight check criteria for every aircraft.

As new aircraft are programmed for the command, standardization board personnel are placed on stateside TDY to gain operational experience and data so that maximum assistance may be furnished tactical units during the conversion period. This assistance is furnished through personal supervision as well as through the aforementioned publications.

Standardization Board members at all echelons are handpicked, highly qualified rated personnel. They all collect and evaluate the latest flying techniques and procedures and work closely with each other in establishing a standardized practice. All data are correlated through personnel conferences, staff visits and integrated staff action at headquarters level before being issued as a command policy. At the present time the transports, fighters, bombers, observers and flight engineers all have their representatives on the USAFE board.

Standardization, based on proven practices, is presented in manuals for every aircraft.

USAFE Manual 55-13

USAFE FIGHTER
STANDARDIZATION MANUAL
T-33

2 JULY 1954

HEADQUARTERS, UNITED STATES AIR FORCES IN E

The Flight Safety Directorate has a three-fold responsibility:

- Implementation of a current program.
- Analyzing incidents and accidents with a view to revealing cause factors for future remedial action.
- Providing statistical data to point out accident trends and problem areas for subsequent staff action.

The educational program is very extensive and includes a monthly briefing that enables the Commander in Chief, USAFE and staff to keep informed on the command accident status. In addition, all commanders attend a quarterly commanders conference similar to CINCUSAFE briefings, and a quarterly meeting is conducted for unit Flying Safety Officers where they exchange accident prevention ideas.

To illustrate the scope and effectiveness of the Flight Safety-Standardization Board team concept, the following are typical areas where joint effort produced best results:

Investigation — Officers in the Directorate of Flight Safety and specialists from the Standardization Board participate jointly in selected aircraft accident investigations. Their special reports receive personal perusal from the Commander in Chief and are forwarded to the appropriate agency separately or with AF Forms 14 for the corrective action.

In keeping with this concept, Flight Safety surveys are conducted by numbered Air Forces at all bases under their jurisdiction. The reports include such things as inadequate airfield lighting, nav-aids, overruns and so on. These reports are studied at Headquarters level for necessary corrective action. The Directorate of Flight Safety maintains a discrepancy file on all bases for use by headquarters in making staff visits.

Incentive Program — This program is carried out at base level and instills *esprit de corps* between units through a competitive spirit. A system has been developed to judge outstanding units for awards.

Accident Analysis — Personal letters are required by the Air Force commanders when an aircraft accident occurs in one of their units. These letters are studied with a view toward taking immediate action to preclude future similar accidents. This procedure permits rapid correction which would not be taken normally until the completed Form 14 is received. When the Form 14 does arrive, it is reviewed to ascertain if additional action is required.

Standardization Checks — The Flight Safety and Standardization Board officers again team up during operational readiness tests to inspect and measure the effectiveness of operating units. Aircrew standardization proficiency checks are mandatory biannual requirements for all pilots in the command. These are performed at base level by the unit standardization officers, and these officers in turn are checked by the USAFE Standardization Board.

During operational readiness tests, the Standardization Board observes operational tactics and spot-checks crews while the Flight Safety member evaluates all phases included in the accident prevention program, i.e., installations, maintenance, flight surgeon participation and equipment.

Many USAFE units will be converting to new high performance aircraft, and the command will be receiving rotational units from the ZI. This challenge will be met through the concerted command team effort. We predict that these efforts will be rewarded. ●

VoL.11 ,No.4

Situations Unlimited

Above, interior view of F-89D jet flight simulator showing the actual simulator in the foreground. The pilot occupies the cockpit on the right with the radar operator seated directly behind him.

Once inside the cockpits of these simulators, the pilot and radar operator both cease to pretend.

T. E. Mulford, Link Aviation, Inc.

THE STRATOJET pilot and copilot were just completing a routine training flight in a Link B-47B simulator. As they turned from base to final approach for the landing, the console operator decided to play a practical joke on them. By merely flicking a few switches, he cut out all three engines on the same side.

The pilot cussed at the simulator, cussed at the operator and fumbled desperately with his controls, but to no avail — he didn't make it.

Everyone thought it was a pretty good joke . . . everyone, that is, except the dismayed pilot. He was thinking about what would have happened to him and his crew if that malfunction had occurred over the landing strip in a real Stratojet, and his thoughts weren't too pleasant.

He persuaded the instructor to give him another go at that landing, and another, and still another until finally he figured out the proper change of trim and throttle to bring his plane in for a safe landing.

About a month later this same pilot and copilot were coming in for another landing, only this time they were in the air over an air base, and not in a Link simulator. And when it happened, no one thought it was a good joke. Because of a fuel system failure, all three engines on one side flamed out.

This was a case where practice really paid off royally. Following the same procedures that he had worked out in the simulator, the pilot made a successful landing. Admittedly he did a bit of perspiring before completing the touchdown but the fact remains that he greased the B-47 in without a scratch.

This incident actually happened. It doesn't prove that practical jokes save lives, but rather it lends credence to the old adage, practice makes perfect.

By this we are not implying that the simulator can ever take the place of actual practice in an airplane. We've all had enough time in the old "blue boxes" to know that somehow things don't always work out just the same when we actually get in the sky. However, the flight simulator does fill a very definite need in our training program. One can make any mistake in the book while flying one of them and still be around to keep trying again and again.

Two simulators now in use by the Air Force are the B-47B and the F-89D, Link's latest contribution to the field of flight simulation. Another simulator, for the Convair F-102 supersonic fighter plane, has recently been completed by Link and soon will be in use by Air Force pilots.

Once inside the cockpit of any of these simulators, you can't tell it from the real plane. Controls, instruments and accessories are carbon copies of those in the plane, and the instruments not only look the same, they react the same.

The C-11B is a trainer rather than a simulator because its cockpit configuration and flight performance do not duplicate any specific aircraft, but rather a general type of aircraft. Basically it resembles in appearance and flight characteristics the F-80 series of fighters.

In most other respects, the C-11B has the same general facilities and characteristics of the larger simulators. It provides training in single-engine jet flight procedures, communications and navigation.

These electronic trainers and simulators, while based on the same principles and patents, bear but slight physical resemblance to their predecessor, the old blue box of World War II fame.

It was found late in the '40s that greater flight realism and flight simulation could be obtained by electronic means rather than by the standard mechanical and pneumatic methods employed in previous trainers.

Link has developed a special electronic analog computer, capable of interpreting flight data in terms of dynamic response, and has since used this computer principle in all of its trainers and simulators.

Contrasted with the comparatively simple and limited early trainers, a modern simulator may utilize over 1635 electronic tubes, 93 servo motor-generator sets, 400 computer assemblies, 275 amplifiers and 1950 gears.

In the short time since the flight simulator became a reality, ground trainers and simulators have become an integral and very important part of the flight training programs of America's air arm. It is now a part of Air Force policy to contract for a new trainer or simulator each time a significantly different model of aircraft is adopted for use.

There's hardly a jet pilot in the sky today who hasn't logged some time in a Link . . . and not without good reason.

Figures published recently by the Air Training Command indicate that use of flight trainers and simulators in Air Force training programs has resulted in tremendous savings of time, money, men and materials.

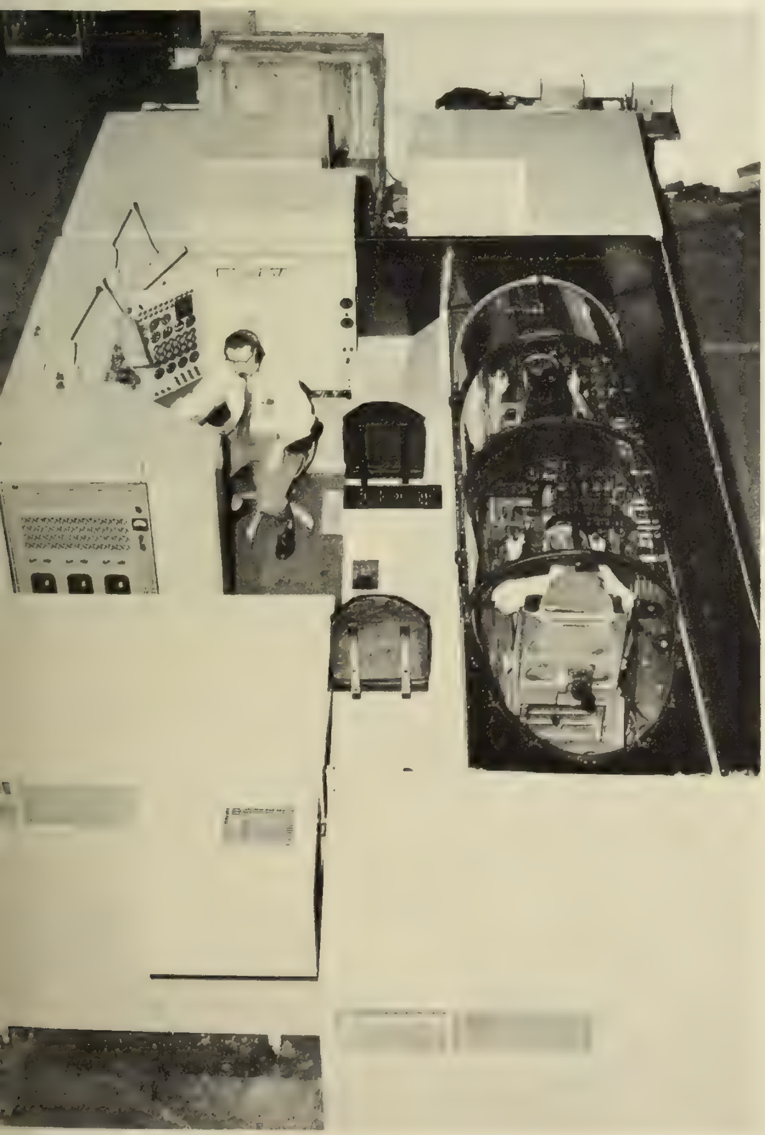
But material savings are not the only benefits derived from the use of these electronic devices. Pilots flying a trainer or simulator get realistic training from the pre-takeoff inspection right through to an instrument landing, and in between the two they can learn to cope with countless emergency or combat conditions.

Included among these are target interception, engine failures or malfunctions, overspeeding engines, loss of engines, flameout, engine fire, icing of engine intakes, hydraulic failure, electrical system failure including inverter failure, over-voltage on generators, alternator failure, circuit breaker failures and hydraulic brake failure.

The value of these emergency training provisions can hardly be overestimated. A coordinated response to unforeseen emergencies is one human capability that cannot be developed in the class room or from books. A speeding jet is a tough place for any man to have to stop and think things out, especially when time is such a vital factor.

Instinctive response, not just general intelligence or reasoning power,

Minus its top cover, the B-47B Flight Simulator provides a tandem cockpit for pilot and copilot. A full complement of instruments and a duplicate set of controls are available to the instructor.



is what often pulls a pilot through an emergency situation. Time in the blue is the best place for practice that leads to instinctive responses. The simulator lays the foundation for actual in-flight proficiency.

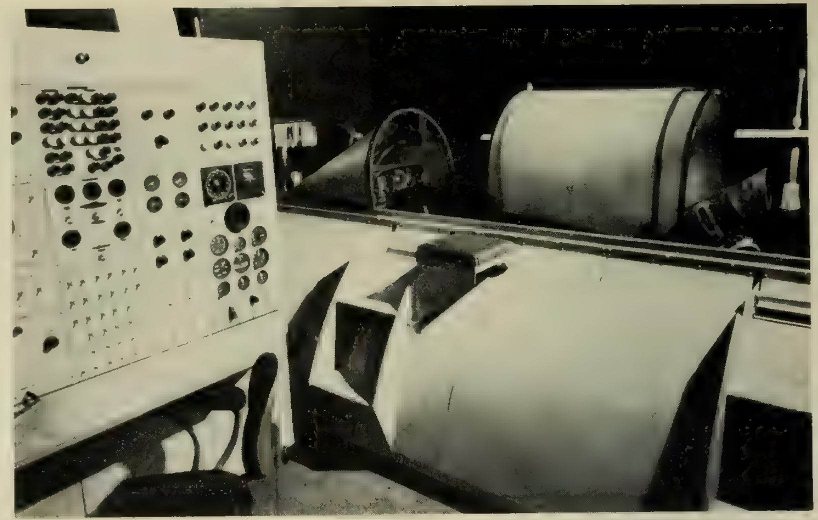
An F-89D pilot of the Alaskan Air Command learned this the easy way. He had just taken off on an intercept alert recently when a warning light indicated a fire in his right engine. This was a new experience to him, and with limited altitude he had to act fast.

Instinctively, he closed the throttle on the dead engine, turned off the right engine generator, turned on the crossfeed, notified the tower of his emergency, blew his canopy clear and proceeded to make a normal landing.

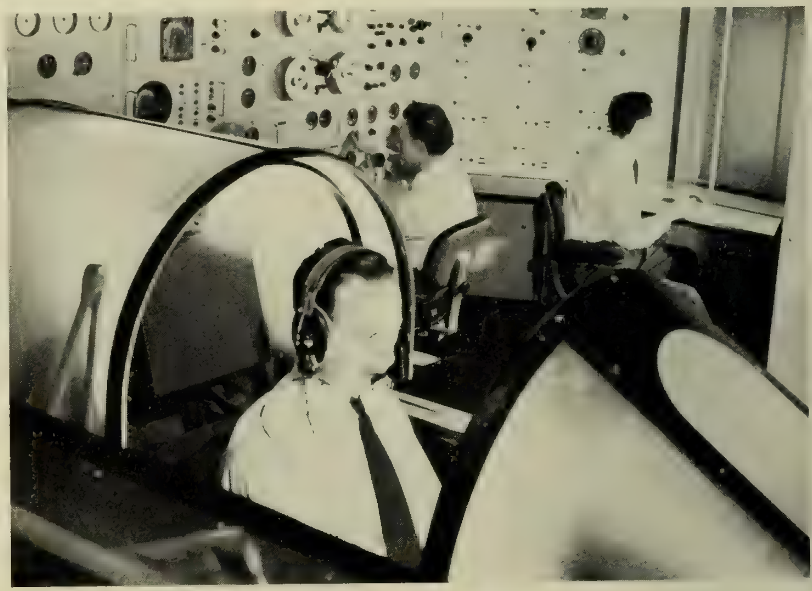
Although this was the first time he had ever experienced such an inflight emergency, he proceeded flawlessly and instinctively just as if he were going through a routine maneuver. He was able to do this for one primary reason . . . he had practiced that procedure several times before, both in his aircraft and in the simulator.

Ground trainers and simulators are not limited to just standard transition type or advanced crew training. Since their instruments can accurately simulate almost any flight or engine condition possible with the actual plane, the training potential of the simulator or trainer is practically unlimited. Add to this the flight recording mechanisms on the instructor's console, and you have a device which insures sound teaching and training practices.

Up in the area of our Northeast Air Command, where most flying is done under instrument conditions, many pilots practice difficult missions ahead of time in their C-11B trainers. If the flight recorder on the instructor's console indicates that a pilot failed to hit his destination, then he practices again and irons out errors until the practice mission is successful.

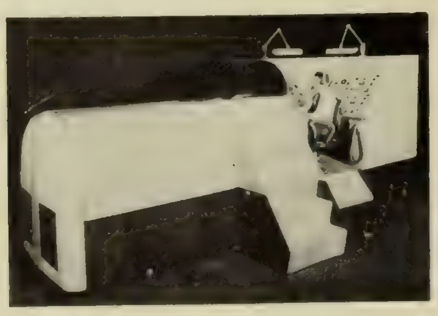


Above, external view of F-89D Flight Simulator. When in flight, cockpits are canopy covered. Jump seats, center, are provided outside of each cockpit and facilitate instructor observation.



The F-89D Simulator in operation shows pilot, concentrating on his instrument panel, with radar instructor, upper left, and flight instructor checking and controlling the entire flight problem.

The C-11B, jet flight trainer, was first all jet simulator to be produced in quantity.



This realistic briefing process illustrates just one of the many extracurricular activities performed by ground trainers and simulators, and it illustrates too the tremendous training potential which these wingless wonders have to offer.

The Directorate of Flight Safety Research has long been on record as advocating the development of new simulators to keep pace with our latest jet aircraft. As we all know, these earth-bound trainers can never take the place of actual flight time but their value in teaching procedures should never be underestimated. Sound procedures are the basis for ultimate development of inflight proficiency.

Our growing all-jet, all-weather Air Force requires greater proficiency on the part of pilots. The very complexity of a modern jet fighter has taken the pilot out of the glamour-boy class and made him a serious, hard working individual. His is a rough row to hoe by any standards. He needs all the help and guidance that science can develop. We believe that the flight simulator, for a particular airplane, is one answer in our quest for the best.

On Course—with 60-16

AIR FORCE regulation 60-16, officially known as "Air Traffic, Clearance, and General Flight Regulations" has often been referred to as the pilot's GOOD BOOK. It is the one reg that pilots have to live with, yet the one most often violated.

That a pilot knows this regulation is important, *I mean real important.* Even in this uncertain era of ours, by complying with 60-16 you can rest assured that you will never be the No. 1 boy on a flying violation rap. What is even more important you considerably enhance the possibility of living long enough to see that grandson of yours check out in the F-1002.

Maybe you know 60-16; if so, you are the exception. I don't think anybody will be too startled if I say that most pilots know less about it than they do about the telephone directory. Just why this is true can well be considered the mystery of the century because, as previously stated, know it and keep out of trouble; ignore it and, brother, you don't know what hardships are.

Granted, it may be a little hard to keep up with the changes. That's one of the reasons for this article: you must expend a little additional effort to keep up with the latest 60-16.

For example, one of the most recent changes requires that pilots accomplish a Form 175 when clearing out of a strictly commercial airport. You are required to carry a supply of forms (175) at all times. If you do go into a non-military field that uses the CAA clearance form only, you must make out a 175, leave the original, then turn in the carbon copy at your destination.

Another change is that landing visibility minimums for Green and White card holders are being published in the current revisions of the instrument approach charts. On the charts not yet revised, minimums will be one mile by day and two by night. The main thing to remember is to look for the published visibility minimum, as well as the ceiling minimum, when making an approved instrument letdown.

The old rule of flying the center of an airway also has undergone some alterations in keeping abreast of the times. For low/medium frequency airways, aircraft will be flown to the right of the center line. On a VOR airway, they will be flown on a radial designated as forming the centerline of the airway.

Also, gone are the days of the 500 on top clearance. Now it's 1000, not 500 on top. Such flights will still be conducted under IFR when over an overcast, as before.

These are some of the changes, and they are mentioned just to prove our point . . . . that unless you keep right on top of revisions to the pilot's GOOD BOOK, you are not in the know. And remember, whether you violate this regulation through ignorance or intent, the results are the same . . . . bad!

Most pilots know less about AFR 60-16 than they do about the local telephone directory.

Along the same line of thinking, it might be well to insert a few remarks concerning deviation from your flight plan while under IFR on airways. We all know that situations can arise necessitating some sort of change in either course or altitude. Maybe ice or turbulence requires a new altitude or maybe you want to circumnavigate a storm center. In either case, get ARTC approval first. Changing to a different altitude because of turbulence or ice, without clearance, could be compared to the old "out of the frying pan into the fire" limerick. You might make the change to get a smoother ride, only to run smack dab into the path of another aircraft.

The important thing to remember is ARTC controls IFR traffic in controlled areas. Don't make a flight plan change without their approval.

In the event of an emergency things are a little different. If you cannot maintain your assigned altitude and for some reason cannot get clearance to descend, declare an emergency and have at it. Nobody, including ARTC, can keep you from going through 9000 if your airplane can't maintain ten. But remember, make every attempt to notify ARTC. Also, in the event of an emergency, you'd better get familiar with paragraph 48 of 60-16. It is entitled "authorized deviations."

Well, that should just about wrap up this little dissertation on AFR 60-16. In case you haven't gotten the gist or if you are the type of guy who doesn't want to take the time, "see you in court." ●

what's the percentage?

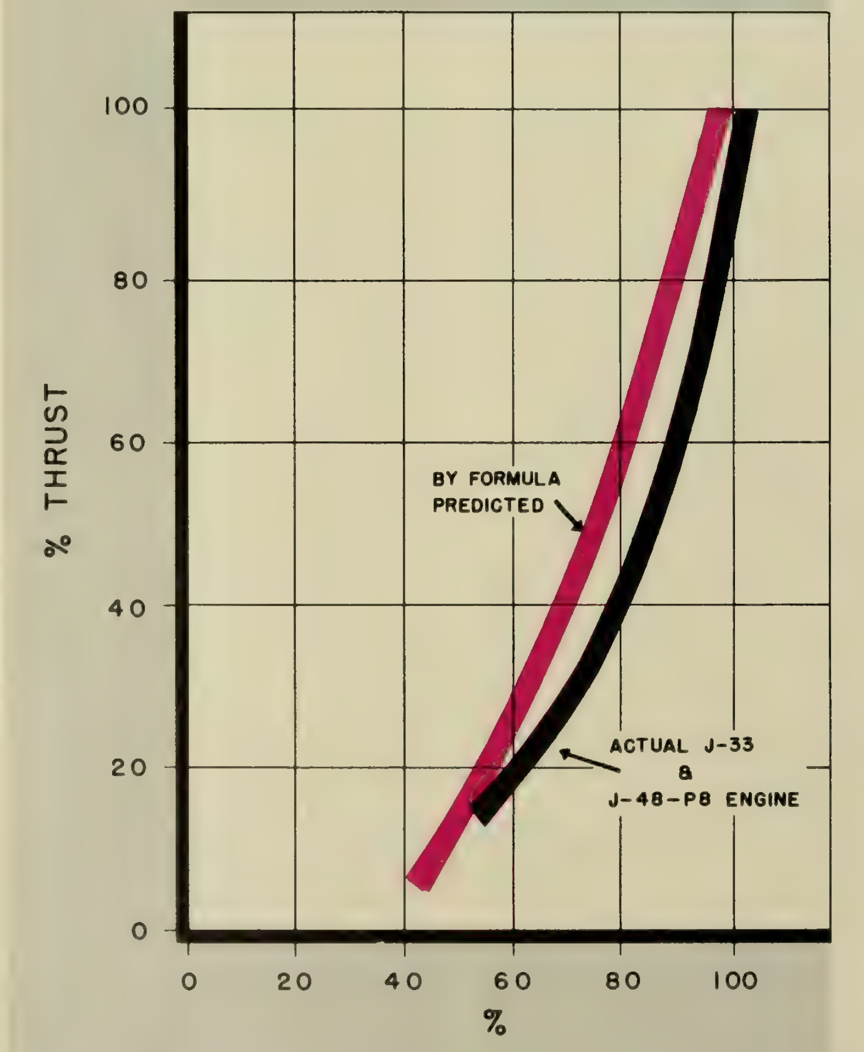


Figure 1

IN this day of measuring fuel in pounds, oxygen in litres and power settings in per cent of RPM, somebody recently came up with a logical question. The fuel in pounds we understand, the oxygen (liquid type) in litres, well, I guess we understand that too, but what about the relationship between the per cent of RPM and the amount of actual thrust? It is confusing when you stop to think that an aircraft with a reciprocating power plant that calls for 43 in. Hq. for takeoff gets off okay, pulling only 35. Yet, try to take an F-84F off sometime, pulling only 80 per cent, or even 90.

Now there is a very logical mathematical formula put together by the engineers that we could go into, but by the time we finished printing it most of us still would be in the dark on the subject. So let the figure experts juggle the complicated equations and square roots. I'm sure we can get at the subject in a "hangar-talk" sort of way. Don't let the simple equation series presented here shake you up. They merely mean that there is a direct relationship between the per cent of RPM indicated on your instrument dial and the actual amount of thrust being blown out the hot pipe.

It may or may not come as a surprise when we say that when you reduce the RPM from 100 to 90 per cent the engine thrust is reduced to 75 per cent. Yes, in taking off 10 per cent of RPM you actually lose 25 per cent of thrust. To carry it even farther, reduce the power setting to 80 per cent RPM and the thrust is cut down to 50 per cent.

You stove pipe jockeys should remember that the relationship of these figures to each other is not affected by any of the standard considerations such as are usually injected into casual pilot's lounge discussions of this problem. By that we mean don't start throwing around terms like thrust, air density, altitude, ram effect or droop —they don't enter into it at all. This proposition refers to any given altitude, and to that altitude only.

Remember, we are speaking of percentages of total thrust available in any given situation, as opposed to your Pilot's Handbook which deals with the problem on the basis of actual pounds of thrust.

Just in case a few of you happen to be mathematically-minded slipstick artists, let's state the proposition technically. Now, don't you other types go wandering off shaking your heads ruefully just because we throw a few figures your way. You're a cinch to understand these basic equations and even if you don't, "this is only the beginning."

Thrust varies directly with $RPM^{3.5}$ which for all practical purposes may be re-stated as: Trust varies directly with RPM, cubed. Use of this proposition is illustrated by the following.

$$\frac{T\ @\ 90\%\ rpm}{T\ @\ 100\%\ rpm} = \frac{90\%\ rpm^3}{100\%\ rpm}$$

By transposing and rearranging we get:

$$T\ @\ 90\%\ rpm = T\ @\ 100\%\ rpm \times .9^3$$

or

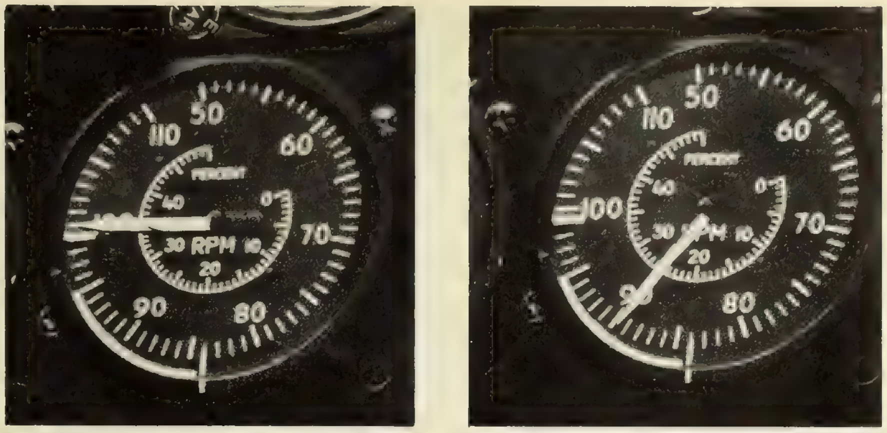
$$T\ @\ 90\%\ rpm = .73 \times T\ @\ 100\%\ rpm$$

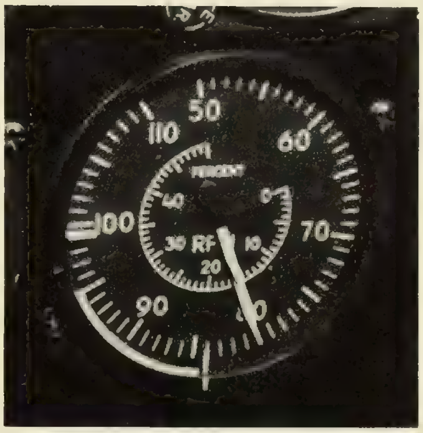
or

$$T\ @\ 90\%\ rpm = 73\%\ of\ T\ @\ 100\%\ rpm.$$

Now that wasn't too bad, was it? It just shows you that 90 per cent of RPM gives you approximately 73 per cent of thrust. However, a word of caution on using the proposition as outlined above: As expressed, it describes the Thrust vs. RPM curve fairly accurately only in the upper limits of the curve. (See Figure 1 which illustrates the engine curves for the J-33 and J-48 engines.) The proposition is not valid for those RPM's which are below 70 per cent. A pilot must check the thrust curves in the appropriate handbook or consult the engine manufacturer's tech representative to obtain available thrust percentages at the lower RPM settings. But the main thing we wanted to bring out was the large actual thrust loss that occurs when you reduce the RPM from 100 per cent to 90 and 80 per cent.

About now it should be obvious that some of the more steaming stones should re-group and give our rule-of-thumb yardstick some deep thought. The proposition, as outlined above, stating that thrust varies directly with RPM cubed can be most revealing. It can be applied to several phases of everyday jet operations.





Using the rule of thumb, the power settings of 100, 90 and 80% of rpm, actually give only 100, 75 and 50% of available thrust.

For instance, there's the boy who comes screaming in on initial and makes a high-speed break. It goes without saying that this familiar character never bothered to find out what his actual thrust is after he has reduced the power setting and cranked around into the pattern. After coming back on the throttle, he throws out the speed brake, shakes around into a wide mushing turn onto a shuddery final, and sets his long-suffering bird down in the toolies, well short of the runway. And chances are he sits there in his battered war machine wondering just what happened. Can't get it through his head that he acted in defiance of the facts that we have outlined, in brief, above.

Now you couple this terrific thrust loss with the inherently poor acceleration qualities of jet engines and you come up with the same answer — into the toolies again.

A case in point is the pilot who likes to fly his pattern at high speed until he screeches around on to final. At this point he whacks the throttle back to IDLE and pops his speed brakes to get down to "all-garbage-out" speed.

This driver kills off speed and winds into final with a complacent air, hoping the boys on the ground notice that a real sizzler is in their midst. He realizes he is settling a little too fast and pours on the coal, but, of course . . . he also ends up slightly short of the strip. He hasn't considered that when you chop things to IDLE it takes time to wind up to an RPM that will give you anything in the way of a boost. The old bugaboo of engine lag teamed up with what we were just talking about to plunk this guy down short.

Someone should have told these two types that it's okay to live it up a little on the ground but when you get into a jet, it's best to know what you are doing. Paying attention to the following rule-of-thumb figures can mean the difference between setting down in the boondocks and laying your aircraft onto the runway for another good landing. Remember:

100% rpm = 100% Thrust
90% rpm = 75% Thrust
80% rpm = 50% Thrust

Those figures mean just one thing to all jet pilots. Keep chopping that throttle way back, boy, and you're a likely candidate for the statistical column entitled: Landed Short of Runway. Cause: Pilot Error. ●

DANGER! Missiles at work

Capt. James M. Neale, Holloman Air Development Center.

WE RECEIVED a very interesting letter recently from Brigadier General L. I. Davis, Commander, Holloman Air Development Center, in which he pointed out some of the dangers of flying across D/209. If that doesn't ring a bell, may we suggest that you refresh your mind by reading the current Radio Facility Chart.

The Holloman-White Sands Range (D/209) is one of the larger, extremely active, land mass ranges used primarily for testing and developing unmanned airborne vehicles. In view of the location and size, it is a matter of quite some concern that aircraft occasionally are flown across D/209, rather than circumnavigate it, in order to save fuel and time. Even if we do not consider the aspects of a violation, careless flying across this or any other danger area may well result in an aborted journey.

Although it may be hard to believe, there are several cases on record of fearless drivers who have deliberately flown through danger areas just to save a few miles and possibly just to unnerve the guided missile troops.

Take that little dog-leg on Amber 3 for example. Between El Paso and Albuquerque the airway jogs to the west at Truth or Consequences. Not much of a jog, mind you, but enough to clear D/209. Ironically enough, straying off airways here may lead to something like the aforementioned name of the city, so best one make the jog or take the consequences.

Of course you are asking for trouble if you stray into or across *any* danger area, but the following bit of verse by Captain James M. Neale lays it right on the line as far as Holloman is concerned:

Once upon a noontime sunny
A B-17 that was a honey
While cruising 'cross our danger range
Got clobbered by a missile strange.

The verse happens to be true and describes the demise of a B-17 drone, but it can happen to you in your shining suit of jet armor unless you avoid Holloman-White Sands.

Naturally, the people down there don't want to scare any brave young airmen or disillusion you into thinking that every aircraft that crosses a danger area is going to be blasted out of the wild blue yonder. Actually, your chances of successfully sneaking across any danger area, without proper clearance, are probably pretty good if you're the lucky type. If you're not, or if by chance you happen to be the poor sad sack who is fresh out of luck at the wrong time, then you'd better steer clear.

If you get caught in one of those "don't-fly-in-here areas" that may be saturated with Mach-busting missiles and other ill-willed objects flashing through the heavens, you have no one to blame but yourself if you get hit. As a matter of fact, you won't be around to meet an F.E.B. or the equivalent anyway.

Guided missiles are still a rarity around the Air Force and as such are restricted to doing their stuff inside designated boundary areas. It just so happens that the Holloman-White Sands Range is about the busiest base that one may imagine and certainly is no place to be flying.

When planning a flight that will be in the vicinity of danger areas, restricted areas or warning areas, take a good look in the back of the Radio Facility Chart. There you'll find at least six pages devoted to airspace restricted areas. The number that is assigned to each is the same number that appears on the planning chart. In addition, the effective altitude and time used is given for each area.

If you should note that your projected flight path would be near a danger area wherein the effective altitude was listed as 30,000 feet and time in use as unlimited, then it would be strictly a game of Russian roulette to barge through that area at 25,000 feet, whether day or night.

A few years ago, a careless flight leader went steaming across one of our southern danger areas. It was a perfectly clear day. The flight was strung out loosely in trail at about 3000 feet. Apparently someone was using comic books rather than charts for navigation purposes. Then, all you-know-what broke out. The air was suddenly full of slugs, and they all meant business.

Fortunately, none of the personnel was struck by wandering bullets, but all of the planes suffered damage of varying degrees. You may well ask, why didn't the gunnery crews hold their fire? Well, it just happened in this case that the armament being tested was of the remote control variety. A lot of ammunition was expended before anyone got around to shutting the mechanical monster down.

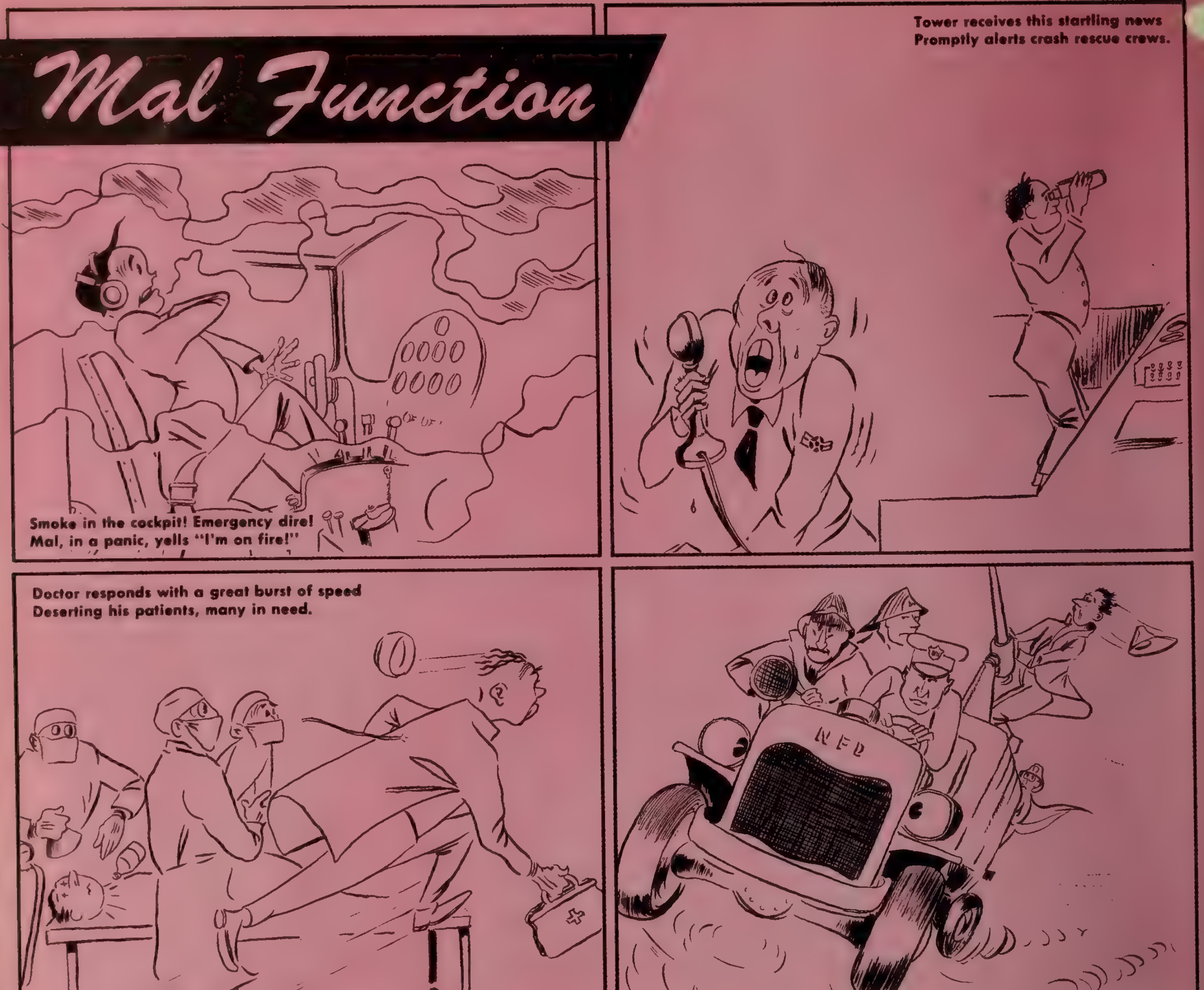
Some of the gadgets that we have today will not only hunt you down in the sky, but if they miss, will turn around and take another whack at you.

Perhaps the day is not too far off when these blasted guided missiles will do us all out of our flying time. To date though, only a few monkeys have ridden them aloft and returned intact. However, we suggest you leave the pilotage of such vehicles to the simian family and for your part (and mine) let's stay as far away from every danger area as possible. ●

Stay out of deep water!

If Confucius were still around, he might come up with something like, "He who doesn't heed 60-16 may find himself in deep water." The article entitled "On Course with 60-16," on page 25 of this issue, should make good reading for all of us who are interested in flying . . . flying right, that is!

Mal Function


Smoke in the cockpit! Emergency dire!
Mal, in a panic, yells "I'm on fire!"
Tower receives this startling news
Promptly alerts crash rescue crews.
Doctor responds with a great burst of speed
Deserting his patients, many in need.
NFD
Fire trucks charge "el bent for leather,"
Everything stops except rescue endeavor.
Mal's most surprised. He'd forgotten to say
He'd discovered smoke coming from dirty ash tray.
As result of this fact he'd forgotten to mention
Mal's now receiving Doc's careful attention.
TRACY

★U. S. GOVERNMENT PRINTING OFFICE . . . 31169

29.1305
LYS

JUNE 1955

FLYING SAFETY

UNITED STATES AIR FORCE

THE LIBRARY OF THE
JUN 23 1955
UNIVERSITY OF ILLINOIS

• Page 4 . . . USAF's New Light Bomber

FLYING SAFETY

VOLUME ELEVEN NUMBER FIVE

Department of the Air Force
The Inspector General USAF
Major General Howard G. Bunker
Deputy Inspector General

Brigadier General Joseph D. Caldara
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

STAFF

Editor
Major Joseph P. Tracy

Managing Editor
Captain John H. Moore, Jr.

Associate Editor
Major Perry J. Dahl

Art Editor
M/Sgt. Steven Hotch

Production
Major Ben H. Newby
T/Sgt. William H. Johnson
T/Sgt. Nicholas Shekitka, Jr.
T/Sgt. G. J. Deen
T/Sgt. Carl E. Fallman
S/Sgt. Al. Fortune

CONTENTS

Page
Crossfeed 2
Swift Black Bird 4
Long, Lean and Lethal 10
Keep Current 12
Summer Flying Hazards 14
Rex Says 16
Nothing Ever Happens To Me 19
For Loss of a Bolt 20
Well Done 23
It's Better When You Help! 24
LOX 28

REX SAYS: See page 16.

SUBSCRIPTIONS

FLYING SAFETY magazine is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished.

★ ★ ★

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in *Flying Safety Magazine*. Contributions are welcome as are comments and criticisms. Address all correspondence to the Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

HOW WELL CAN YOU REMEMBER?

The questions in this quiz are based on the last three issues of FLYING SAFETY (April, May and this issue). The answers are in the box at the bottom of this page; but no fudging, take the test and *then* check your answers. Watch it though, if you miss more than five, you don't pass!

APRIL

1. What is the average jet engine acceleration time?
   - *a. 5 - 10 seconds.*
   - *b. 10 - 15 seconds.*
   - *c. 15 - 20 seconds.*

2. The ventilated portion of the pressure suit will keep a man in thermal balance with cockpit temperatures of:
   - *a. 90 degrees F.*
   - *b. 140 degrees F.*
   - *c. 190 degrees F.*

3. Records indicate that 80 per cent of all tornadoes occur between:
   - *a. noon and midnight.*
   - *b. sunset to sunrise.*
   - *c. during daylight hours.*

4. The C-11B is a trainer rather than a simulator because its cockpit configuration and flight performance do not duplicate any specific aircraft.
   - *a. True.*
   - *b. False.*

5. Visibility minimums are being published in the current revisions of the instrument approved charts.
   - *a. True.*
   - *b. False.*

6. When you reduce engine RPM from 100 per cent to 90 per cent the engine thrust is reduced to:
   - *a. 90 per cent.*
   - *b. 85 per cent.*
   - *c. 75 per cent.*

7. When planning a flight in the vicinity of a prohibited restricted or warning area, check the:
   - *a. Radio Facility Chart.*
   - *b. AFR 60-9.*
   - *c. Supplemental Flight Information Book.*

MAY

8. The C-123 is equipped with fully reversible props.
   - *a. True.*
   - *b. False.*

9. In all cases when landing a B-47 aircraft, the outrigger will prevent dragging a wingtip or outboard engine.
   - *a. True.*
   - *b. False.*

10. Fewer compressor stalls occur in centrifugal jet engines because they operate at a much higher pressure ratio.
    - *a. True.*
    - *b. False.*

11. It is possible to make a VFR arrival or departure at a base where local IFR weather conditions exist.
    - *a. True.*
    - *b. False.*

12. The Bendix Carburetor installation on a B-25N can be identified by:
    - *a. Location of the airscoops in the nacelles.*
    - *b. Checking the engine access door.*
    - *c. Reading placard on engine nacelle.*

13. The F-89D is restricted from spinning because of the excess weight of the wingtip rocket fuel pods.
    - *a. True.*
    - *b. False.*

JUNE

14. Partial flaps are used for normal takeoff in B-57B aircraft.
    - *a. True.*
    - *b. False.*

15. An advantage to liquid oxygen is that its combustion potential is low.
    - *a. True.*
    - *b. False.*

16. The region west of the Continental Divide is the predominant thunderstorm area.
    - *a. True.*
    - *b. False.*

17. A running pick-up can be used if hovering or landing are impossible during a helicopter rescue.
    - *a. True.*
    - *b. False.*

18. "Useful consciousness" at between 30,000 and 35,000 feet is about:
    - *a. 10 seconds.*
    - *b. 30 seconds.*
    - *c. 60 seconds.*

ANSWERS

APRIL
1. b.
2. b.
3. a.
4. a.
5. a.
6. c.
7. a.

MAY
8. a.
9. b.
10. b.
11. a.
12. a.
13. b.

JUNE
14. b.
15. b.
16. b.
17. a.
18. b.

LETTERS TO THE EDITOR

Jet Special Studies

When, if ever, are you coming out with another up-to-date jet special study? Your last one was very well received here and my copy is getting a little dog-eared from so much use.

If for some reason you are not planning to prepare and distribute another special issue of all jet operations, I would like to know so that I can dig through the old mags and make up my own list for future reference.

If you are planning a special study, when will it hit the field?

In closing, I would like to congratulate you on the good job you are doing on the magazine.

Major Thomas J. Williams
U.S. Air Force

Thanks for your letter. A selected study on jet operations and flying techniques is at the printers now and should be ready in about three weeks. They will be available upon request through your base Flying Safety Officer.

Experimental Jet Logs

I am submitting the attached exhibit on behalf of the Jet Flight Log problem, especially from the standpoint of the single seat type aircraft.

Over a period of 12 months much cross-country flight experience was obtained (T-33 type aircraft) and many local type Flight Progress Charts or Logs of varying nature and design were used. This afforded ample opportunity to develop a flight chart to one's particular standards.

The following provisions were adhered to completely . . . pertinent data — included . . . irrelevant data — excluded . . . space—alloted as seemed necessary . . . order or system—placed so the data progress naturally.

The front side contained:

Letdown: Make certain that destination has a Jet Letdown and that same is in possession of pilot.

Service: Assure that the aircraft was fully serviced and entry made to that effect in Form 1.

EGT: Max. and actual, very important for some type of jets.

Oil: Pressure at takeoff, a necessary figure for some aircraft.

Cruise: Insert as seen fit: climb-tips full — tips out — pylons full — pylons out — etc.

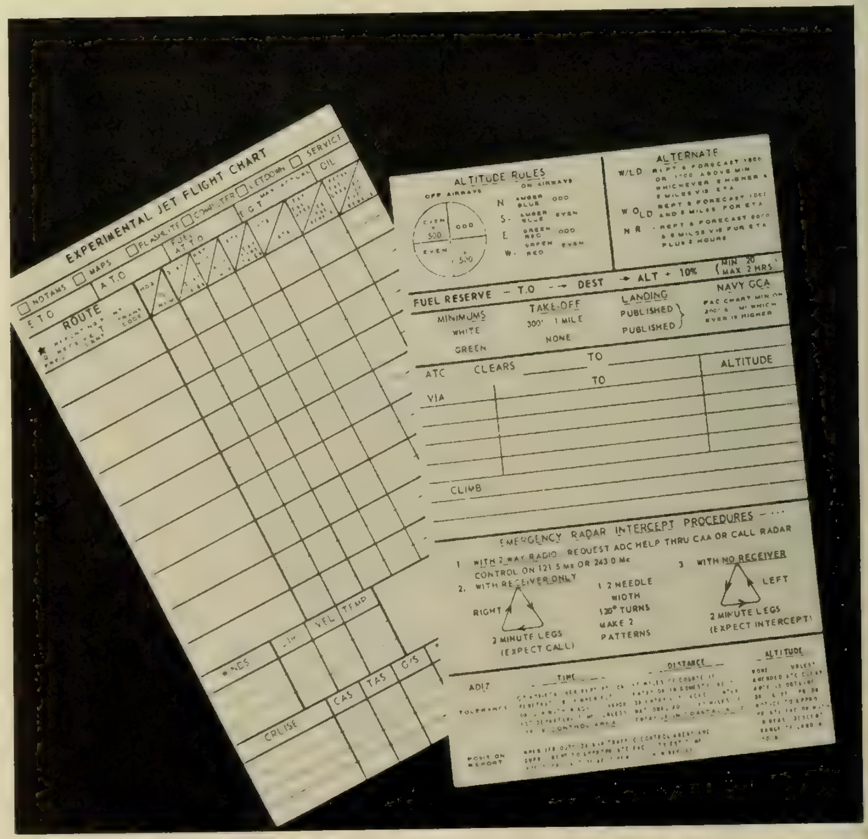
R.F.: Here the range factor is inserted. Under *Range* or *Endure* is inserted distance for range and/or time for endurance.

Comments from other pilots in the squadron were favorable concerning this experimental jet flight chart.

With the aim of offering this type of jet chart to as many pilots as possible, six copies are being sent to the USAF Aeronautical Chart and Information Center (Research & Liaison), Washington, D. C., for whatever use they may think necessary or practicable.

Should these charts be approved for widespread use, reference may be made to the form number in the

In the constant quest for simplification, these experimental jet logs are another step forward.



EXPERIMENTAL JET FLIGHT CHART

☐ NOTAMS ☐ MAPS ☐ FLASHLITE ☐ COMPUTER ☐ LETDOWN ☐ SERVICE

E T O | A T O | FUEL AT T.O | E G T MAX ACTUAL | OIL

ROUTE

WINDS | VEL | TEMP

CRUISE | CAS | TAS | G/S

ALTITUDE RULES

OFF AIRWAYS: EVEN + 500 | ODD | EVEN | + 500

ON AIRWAYS

N. AMBER BLUE ODD

S. AMBER BLUE EVEN

E. GREEN RED ODD

W. GREEN RED EVEN

ALTERNATE

W/LD RPT & FORECAST 1000 OR 1000 ABOVE MIN WHICHEVER IS HIGHER & 3 MILES VIS ETA

W O LD RPT & FORECAST 1000 AND 3 MILES FOR ETA

N R RPT & FORECAST 3000 & 3 MILES VIS FOR ETA PLUS 2 HOURS

FUEL RESERVE — T.O → DEST → ALT + 10% (MIN 20 MAX 2 HRS)

MINIMUMS	TAKE-OFF	LANDING	NAVY GCA
WHITE	300' 1 MILE	PUBLISHED	PAC CHART MIN OR 200' & ½ MI WHICHEVER IS HIGHER
GREEN	NONE	PUBLISHED	

ATC CLEARS ______ TO ______ ALTITUDE

TO

VIA

CLIMB

EMERGENCY RADAR INTERCEPT PROCEDURES

1. WITH 2 WAY RADIO REQUEST ADC HELP THRU CAA OR CALL RADAR CONTROL ON 121.5 Mc OR 243.0 Mc
2. WITH RECEIVER ONLY
3. WITH NO RECEIVER

RIGHT — 2 MINUTE LEGS (EXPECT CALL)

1 2 NEEDLE WIDTH 120° TURNS MAKE 2 PATTERNS

LEFT — 2 MINUTE LEGS (EXPECT INTERCEPT)

ADIZ — TIME — DISTANCE — ALTITUDE

TOLERANCE

POSIT ON REPORT

lower right hand side of the chart, viz., Air Force LAFB — L — 4 — 850. The 2200th Field Printing Unit at Langley AFB, Va., has the plates on file. Thus duplication in reproduction costs would be eliminated.

Capt. Robert A. McCauley
509th F-B Sq
Langley AFB, Va.

We're passing along to our readers another good idea from the field. Don't forget to send us yours!

His Best Uniform

The pilot and instructor pilot carefully prepared for their flight to a destination 1 + 30 away by T-Bird. Maps were prepared properly, flight log made out and flight plan given a lot of thought. The form 175 was signed and telephoned to flight service. Clearance was received and the pilots proceeded to their T-Bird with their luggage and flight gear.

The luggage consisted of the pilots' clothing contained in a thin plastic bag. This was draped over the radio equipment in the left nose section of the '33 and the gun bay door secured.

Proper walk-around check was completed, everything okay. A start was made and taxi-out accomplished. Takeoff was normal and the aircraft bored up through the overcast.

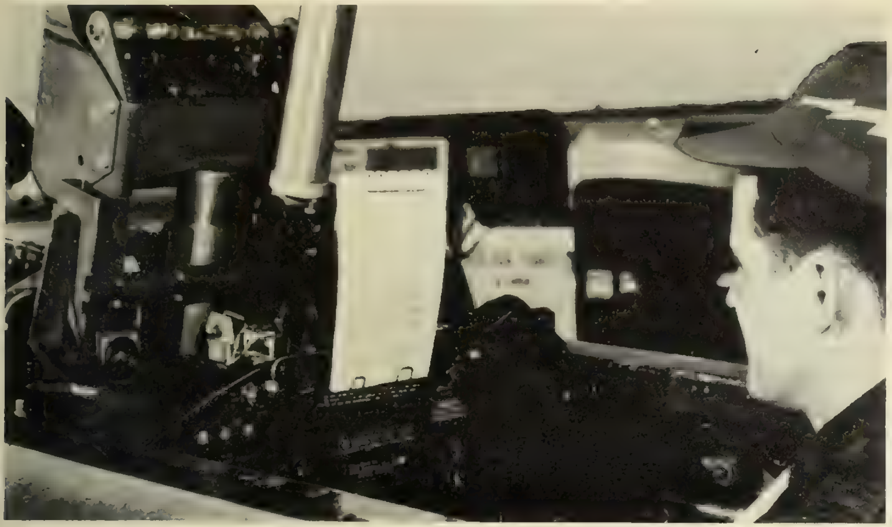
Everything was beautiful for the first 100 miles. Then the No. 1 inverter failed, but the pilot switched to the No. 2 inverter and continued on course. At the end of the second hundred miles the No. 2 inverter failed; however, with VFR conditions there was no sweat, and they landed okay.

A good landing was made at the destination: taxi-in, parking and shut-down were accomplished okay. The pilot wrote up the failed inverters on the Form 1.

The luggage was taken out of the nose and then the swearing started. Both the blouse and trousers belonging to the instructor pilot had been burned completely through. The only clothes he had along were ruined and he had to stay all night. To top it off it was his newest blues — purchased just a month ago. Bye, bye $85.00.

The pilots had hung their clothing over the air intake side of the inverters; without air the inverters burned out. Heat from the inverters burned the radio cable and destroyed the pilots' clothing. Two inverters and one coaxial cable to the ARC-27 also were listed as casualties, along with the uniform.

Capt. George M. Hall
Hqs 4th AF (IG)
Hamilton AFB Calif.

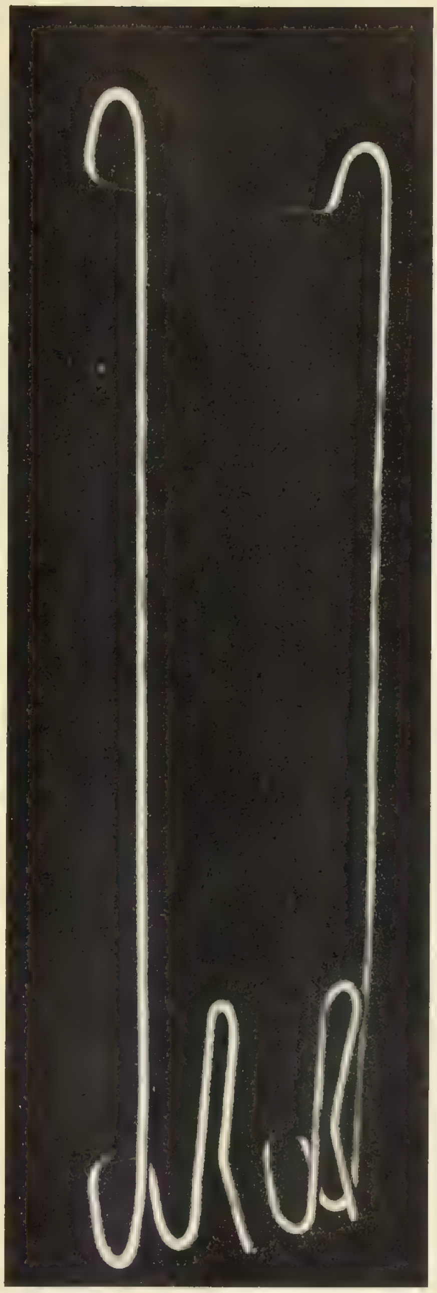


A holder for the jet letdown chart, improvised from a coat hanger, fitted on the panel of a T-33.

A Holder for your Chart

1st Lt. Donald Robison, one of the jet fly boys here at Tyndall, got tired of dropping his jet letdown chart or trying to squint over his oxygen mask to get his inbound heading. He decided to do something about it. The attached photos show the results of his labor. This is a very simple device made of coat hanger wire and takes about five minutes time.

As you can readily see, the holder puts the letdown chart right in the middle of the normal instrument cross-check used while flying on the gages. The booklet that is being held is the local production made by the instrument section of the F-86D course here.



I feel that this gadget is of a general interest nature and could be used in almost every outfit that is flying the T-Bird.

Lt. Col. Albert N. McCreight
FSO, 3625th CCT Wg (Int.)
Tyndall AFB, Florida

The Lieutenant's American ingenuity is showing. This is about as sound a gimmick as we've ever seen, inexpensive, too.

Swift BLACK

During starting operations, black smoke from the cartridge escapes from the engine exhaust port.

Originally designed by the British in 1944, the Canberra, so named after the Australian city, made its first flight on Friday, 13 March 1949. To date it holds 10 official World Class performance records.

Upon request from the United States Air Force, the Glenn B. Martin Company purchased the design. The adaptable Canberra airframe was taken, existing electronic equipment was added to this airframe and engineering improvements were undertaken and accomplished. The two Wright Aero J-65 turbo-jet engines rounded out the changes that have resulted in the light bomber designated the B-57B.

IT WAS A BALMY afternoon as the Base Operations Officer silently shuffled through the stack of papers that filled his IN basket. It was serene and quiet; quiet, that is, until the Ops Officer jumped to his feet, screamed, "Fire on the flight line" and made for the front door. Black smoke poured from the engine nacelle of a sleek, black, multi-jet bomber, but as everybody was soon to discover, where there's smoke there's not necessarily fire.

The black smoke originated from the cartridge type starter unit of this airplane and is just one of the unique innovations that has arrived on the Air Force scene along with the light bomber, jet (B-57B).

The B-57B, readily distinguished by the large chord of the wings, is a streamlined, all-metal monoplane, powered by two Wright Aero J-65 engines. It is highly maneuverable, even at extreme altitudes, and is capable of performing acrobatics such as rolls, loops and Immelmans.

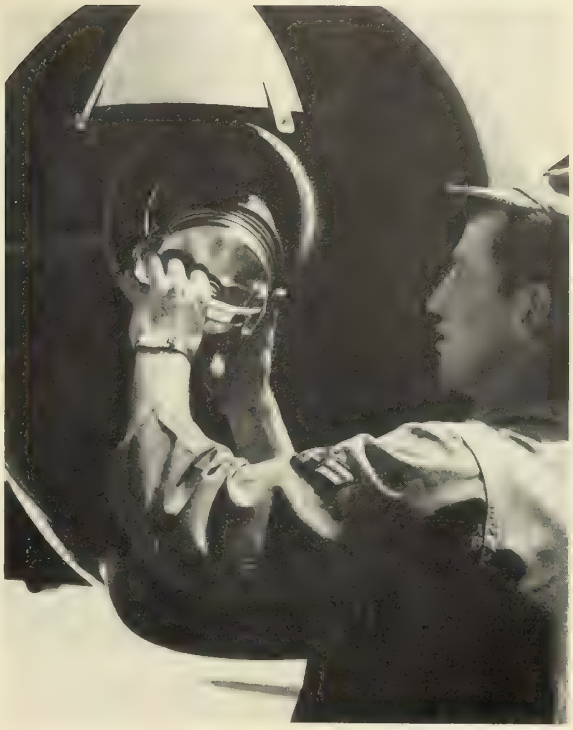
The aircraft has a pressurized, air-conditioned cockpit that provides tandem seating for a pilot and an observer and is equipped with two jettison-type seats.

Gone are the close, cramped working quarters so often associated with the cockpits of jet aircraft. The office of the B-57B, for both pilot and observer, can be called roomy.

Both crewmembers are covered by a single, bubble-type canopy that is hinged at the rear and raised or lowered by means of a hydraulic actuator. In an emergency it can be jettisoned by explosive canopy remover.

As previously noted, one of the most outstanding features of the B-57B is the cartridge type starter system. The aircraft has no electric inertia starter, consequently no external electrical power source is needed for starting. Instead, the power is obtained from a cartridge of slow-burning powder that is inserted into a removable breech housed in the bullet-nose of each engine. The power from this burning cartridge is transmitted to a small turbine wheel then through a series of gears to the engine drive-shaft. This one-shot cartridge will accelerate the engine to a speed sufficient to support combustion in 10 seconds.

Another interesting feature is the rotary type bomb-bay door. The door is unique both in design and in op-



Starting cartridge is inserted in removable breech in the bullet nose of each engine.

eration. It is constructed in such a manner that the bombs are attached to the door instead of to the structures inside the bomb bay. Prior to starting the bomb run, the door is rotated 180 degrees about its longitudinal axis. This places the bombs outside the airplane and the outer surface of the bomb door inside the aircraft fuselage, completely sealing the bomb bay. The door is electrically controlled and hydraulically rotated with hydraulic pressure holding the door open or closed.

Welcome news to pilots of the Tactical Air Command is that it is not necessary to slow the aircraft down to open the door and there is little or no noticeable effect on trim when the door is full open.

Still another added attraction to the B-57B is the liquid oxygen system. The LOX system can supply more oxygen per pound of equipment weight than either the low or high pressure gaseous systems.

The B-57B oxygen system holds 4.5 litres (liquid) and a rough working approximation is the assumption that one litre of liquid oxygen will supply about three manhours of gaseous oxygen. (Of course, the actual duration is dependent upon altitude, cabin pressure and so on.) Before taking off on an extended cross-country flight the current Radio Facility Chart should be consulted to be certain the point of intended landing has LOX available.

Aircrew training in the B-57B centers around the 3515th Squadron of the 3510th Combat Crew Training Group at Randolph AFB. They have the dual responsibility of training both pilots and observers, the vast majority of whom come from the Tactical Air Command.

The 3515th, as well as the trainees, feels strongly about developing and maintaining the pilot-observer team concept and the students are formed into teams prior to arriving in the squadron for training. With the exception of specialized phases of training for each crewmember, the teams study, fly and are returned to operational units as a team.

The majority of the student pilots are past masters in the B-26, but are totally unfamiliar with the idiosyncrasies of jet aircraft. Not only must they be instructed in the operation of a new, tactical bomber, but they must also be taught the procedures required to meet the more critical demands of jet operation.

While attending the school, pilots receive a total of 50 hours of actual flying, of which the first 25 are in T-33s. Each pilot must qualify for the standard jet instrument certificate before beginning transition in the B-57. In addition to the 50 hours of flight time, the student pilots are given 84 hours of instruction under the flying training phase of the school. This includes mission preparation and briefing, postflight debriefing, critique and grading and instruction in the C-11 and C-8 synthetic trainers. In the future, additional time will be spent in the new B-57B procedures trainer now being built at Randolph.

Flight time in the T-Birds covers day and night transition, instrument instruction and practice, solo navigation and cruise control. The flying time in the B-57B is devoted to day and night transition, instrument instruction, navigation, Shoran indoctrination and practice tactical missions.

Student pilots also receive 229 hours of academic instruction including aviation physiology, aircraft systems and procedures, instrument flying techniques, high altitude weather,

A ground school training aid shows fuel-flow control panel arranged in a schematic flow pattern so that overall operation can be seen at a glance.

bombing and gunnery equipment, special weapons and survival training.

Student observers receive a total of 56 hours of flying training, with 21 hours of actual flight in the B-57B. Their academic course runs 230 hours and covers much the same subjects as the student pilots', with more emphasis being placed on navigation and equipment procedures and less on aircraft systems and instrument procedures. Observers are graduated from the school as specialists in the operation of the Shoran equipment as well as in navigation.

Instructors impress on the observers and pilots alike, that in order to utilize the B-57B effectively, each crewmember has a definite function. If either the pilot or the observer falls down on his job the aircraft might as well have stayed on the ground. There is little need for the pilot to take off if the observer miscalculates and cannot find the target. Likewise, there is no need for the observer to be proficient in the Shoran equipment if the pilot can not provide him with a desirable platform. They must work as a team, from takeoff to landing.

The best way to find out about any airplane is to ask the man who flies it. Without exception, pilots of the 3515th feel that the B-57B is so easy to fly that the only real danger is complacency. True, like any other airplane it has design limits that can not be ignored. However, fly it right and you will be pleasantly surprised with its handling characteristics.

Starting

The actual starting procedure for the B-57B is probably as simple as you have ever seen. First, of course, the interior, pre-start checklist is accomplished. Then when the starter switch is placed in the START position, ignition is provided for about 15 seconds during which time a primer valve is opened, providing fuel automatically. All the pilot need do is sit there as the tailpipe temperature rises and the RPM begins to build up. As the instruments stabilize at normal readings, the throttles may be advanced to full power, as no warm-up is necessary.

It will take about 75 per cent rpm to get the airplane moving for taxiing. The nose gear is of the full swivel type and steering is accomplished through the use of the brakes. Jockeying the throttles to make small turns will be ineffective because of the low acceleration rate of the jet engines.

Takeoff

After running through the pre-takeoff checklist you are ready to leap off. As you apply 100 per cent rpm and release the brakes for the takeoff roll, you notice a definite nose-up tendency. You have a sensation of the airplane's attempting to leap off the ground, which, in a sense, is true. You have a tremendous amount of power pushing you forward. A considerable amount of forward pressure on the control column becomes necessary to counteract this initial nose-up tendency but this decreases as the airspeed increases until back pressure is required to bring the nose wheel off the runway.

Upon breaking ground the aircraft accelerates rapidly. Therefore it is necessary to get the landing gear up as soon as possible to keep from exceeding the structural limitations of the landing gear doors. After gear retraction you may notice an initial

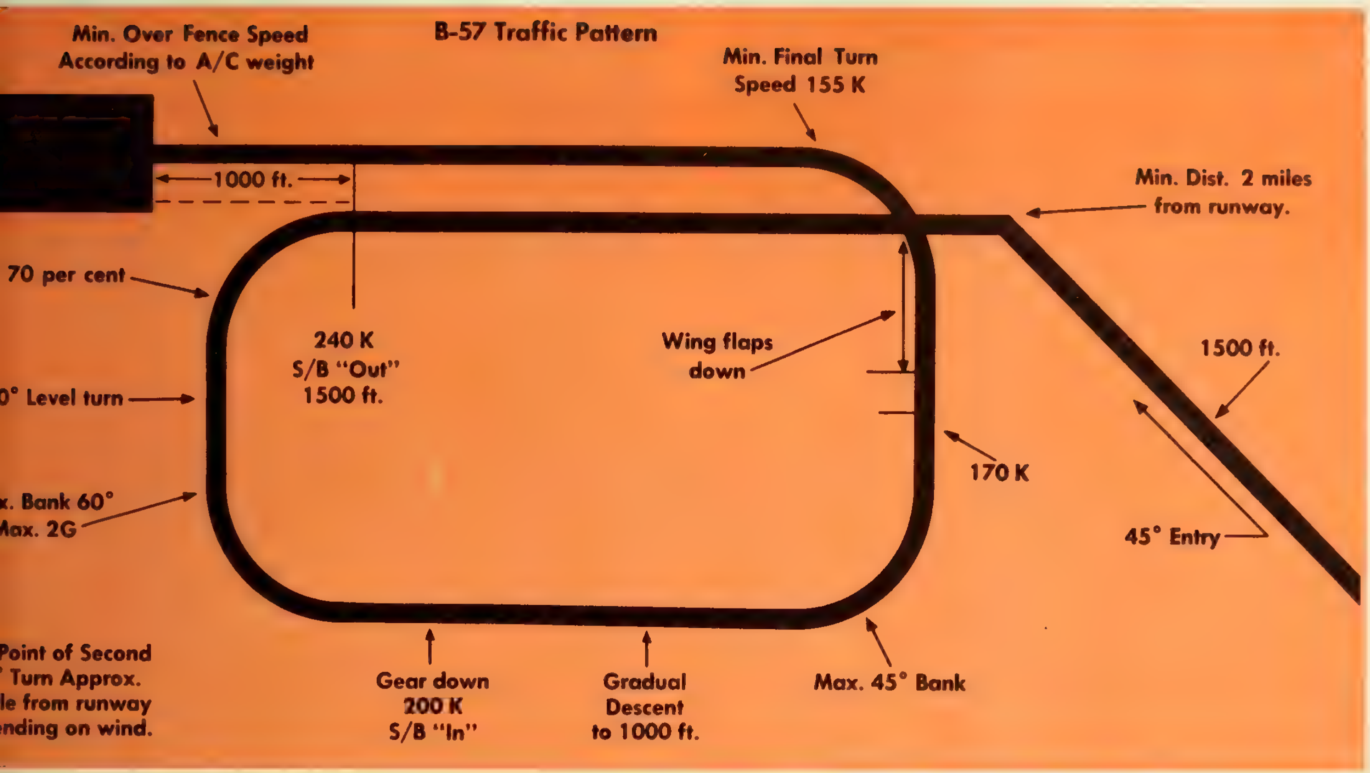


Figure 1. Recommended landing pattern shows speeds and configurations.

pitching down movement, but this is very slight and can be controlled easily with additional stick-back pressure.

Currently, the TAKEOFF position on the emergency fuel system will not be used. Operation of the emergency fuel system while the switch is in the TAKEOFF position is unsatisfactory because under certain conditions the emergency system will cut in unexpectedly at engine speeds as high as 95 per cent rpm.

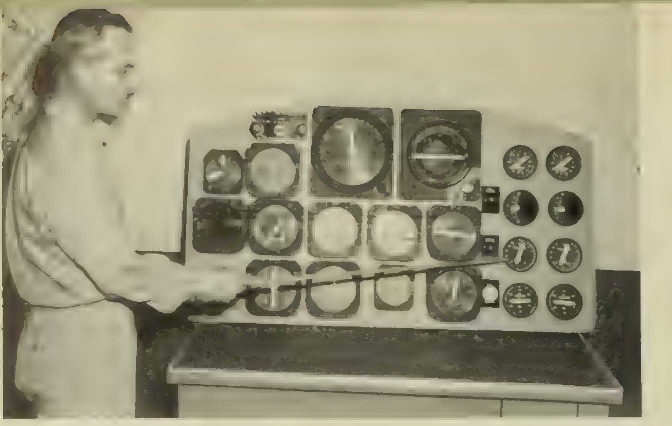
In Flight

Fuel management in any jet aircraft is an all-important crew duty. Fuel is stored in four internal tanks, two of which are located in the fuselage and one in the leading edge of each wing. Also, droppable wing tiptanks may be installed.

The fuel flow control panel is arranged in a schematic flow pattern and overall operation can be seen at a glance.

All fuel normally flows into the No. 1 fuselage tank, thence to the engines. However, fuel can be fed directly to the engines from any of the fuel cells by use of a by-pass control.

L/Col R. C. "Pappy" Craddock, 3515th Squadron Commander, states, "The B-57 is so easy to fly that the only real danger is complacency."



An instructor discusses procedures, using simulated instrument panel.

On the trim tab mock-up, tab can be actuated to demonstrate operation.

Booster pumps in the No. 1 fuselage tanks are controlled by a switch on the flow panel, and this switch is safetied in the ON position. The booster pumps on the other internal tanks are operated automatically when the respective tank is selected on the panel.

The recommended procedure for routing fuel is to takeoff with the wing tanks feeding into the No. 1 fuselage tank. After approximately five minutes of flight, switch to the No. 2 fuselage tank and run it dry. The majority of the pilots in the 3515th make this switch when passing through 5000 feet and incorporate it into their normal 5000-foot checklist, i.e., oxygen, fuel flow and so on. After the No. 2 fuselage tank is dry, the tips are then used and finally the wing tanks.

A word of caution. It is important to burn the No. 2 fuselage tank out first to prevent creating an unfavorable aft center of gravity load factor. The initial five minutes of flight on the wing tanks is performed to reduce the possibility of siphoning.

The tiptanks on the B-57B have a tendency to feed unevenly, creating a one-wing heavy condition. This can be corrected by using aileron trim; however, this is not recommended. The fuel system is designed so that each tip can be used individually and it is recommended that the aircraft be kept in trim by evening out the tip-tank fuel rather than by using the aileron trim tab.

There is a gage indicating fuel quantity in pounds in each internal tank so that the pilot should be able to tell at a glance just how much fuel is remaining.

The B-57B is extremely clean aerodynamically, and with the tremendous amount of power available through the J-65 engines, care must be taken to prevent exceeding the structural design.

The aircraft is equipped with speed brakes located in the aft portion of the fuselage and dive brakes which, when actuated, protrude vertically out of the wings. The speed brakes, appropriately nicknamed "the barn doors," are controlled by a switch on the control panel, and the degree of extent is controlled by the length of switch actuation. The dive brakes consist of drag channels that are located in the upper and lower surfaces of the wings and extend when the speed brakes are opened. There is a total of 21 channels in each wing, 12 on the underside and 9 on the top. They are one and one-half inches square and extend about four inches from the wing skin.

The speed and dive brakes are extremely effective and when extended it is not difficult to descend and remain within the speed limitations of the aircraft. The normal descent procedure is to extend the brakes and place the throttles in IDLE.

Landing

The landing flaps are of the full drag, no-lift type, and are in either one of two positions: Full up or full down. The flaps consist of four panels, two in each wing, and each panel has its own actuating cylinder. An interesting note concerning the aircraft's stability is that with one panel inoperative the aircraft is completely controllable at all speeds. In fact, the aircraft has been landed in this configuration without the pilot even realizing it. Although the aircraft is controllable with two panels on one side inoperative, under these conditions a no-flap landing should be accomplished.

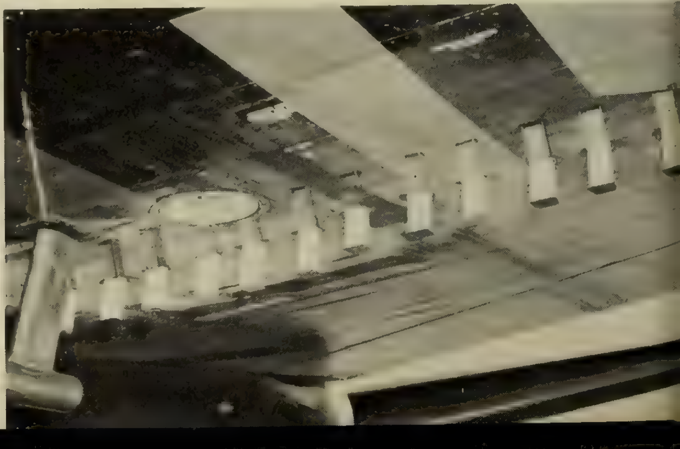
As the flaps offer no lift they are not used for takeoff and should be retracted immediately in the event of a go-around or single engine.

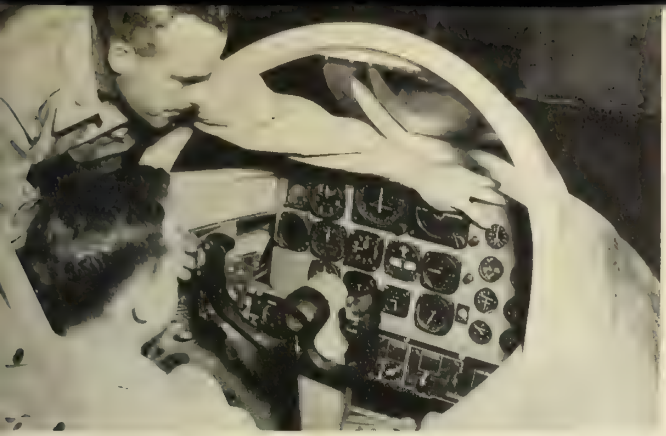
The flaps normally are extended just prior to turning onto final and remain full down for the remainder of the landing pattern. (See Figure I)

The B-57B has been described as a pilot's dream to land. Not that the pilot can fill out the Form 1 while

Wing flaps can be used in only two positions: Full Up or Full Down.

Dive brakes protrude from the wings when the speed brakes are opened.





A B-57B cockpit procedures trainer is used for student orientation.

Speed brakes, aptly nicknamed "barn doors," operate hydraulically

on final, but the aircraft has a natural tendency to flareout when the power is reduced to IDLE.

Following the "break" and entry into the landing pattern, a small amount of forward trim is needed as the landing gear is extended. And an additional amount will be required as the flaps come down. Forward pressure on the control column must be used during the final approach, and a normal round-out and main-gear-first landing is made. The distance covered during the landing roll is amazingly short. It is comparable to that distance required by today's reciprocating engined, light bomber.

Except at critically low airspeeds, the loss of one engine on the B-57B should pose no serious control difficulties. Once speed has been attained the aircraft will climb, maneuver and land in a very satisfactory manner. It will maintain level flight with one engine operating at 80 per cent rpm.

If an engine becomes inoperative at critically low airspeeds, a terrific yaw effect takes place. Since there is no boost assist on the rudder, the pilot must apply foot pressure plus trim, in order to maintain directional control. A figure of 155 knots is listed as the minimum controllable speed. The minimum controllable airspeed is definitely dependent upon how much physical force the pilot is able to exert on the rudder pedal, as there is more than enough power available for acceleration.

The airstart procedure is almost as simple as a normal ground start. Merely stop-cock the throttle, drain the tailpipe, adjust the airspeed to attain 14 to 20 per cent rpm and move the starter switch to CRANK ONLY. Then open the throttle slightly above IDLE and as soon as the tailpipe temperature rises retard the throttle to IDLE. When the RPM stabilizes, advance the throttle to cruise, and you're off.

Landing with one engine inoperative is basically the same as a normal landing. The main difference is in maintaining airspeed and making a go-around decision sooner, so that sufficient speed and altitude will be available to perform the go-around.

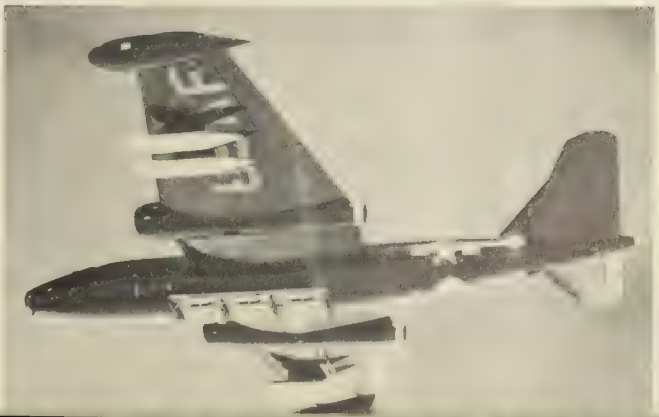
If an engine-out landing becomes necessary, the extremely effective drag qualities of the wing flaps and speed brakes must be considered carefully. It should be noted that with the speed brakes out, and the wing flaps and landing gear extended, the aircraft cannot maintain altitude with one engine inoperative.

A normal entry on initial approach should be made at 1500 feet with an IAS of 240 knots. During the entire engine-out landing pattern, the angle of bank should never exceed 45 degrees. The pitch out should be made approximately 1000 feet short of the runway with a minimum IAS of 200 knots and a definite downwind leg should be established. The airspeed should be reduced to no lower than 190 knots and a descending turn made onto the base to an altitude of 1000 feet. At this time the gear should be extended and the turn onto final completed at not less than 500 feet. As soon as it is definitely assured that the runway can be reached, a minimum of 160 knots and maximum of 170 knots should be maintained until the flaps are lowered. After the flaps are down the airspeed should be reduced to the best approach speed for the weight involved. At this point the aircraft is committed to land and a go-around is then out of the question.

Well, here's hoping you now have a little better picture of the aircraft that you are bound to be seeing a lot of, real soon. The BRAVO FIFTY SEVEN is a straight-forward airplane and actually a pleasure to fly. Its flashing acceleration, performance and simplicity of operation, make it a rarity among twin-engine aircraft. In a word, IT'S A HONEY! Mute evidence of how pilots feel about it is reflected in the large backlog of applicants requesting B-57B transition training at Randolph. ●

The single, bubble canopy is hinged at the rear to afford easy entry.

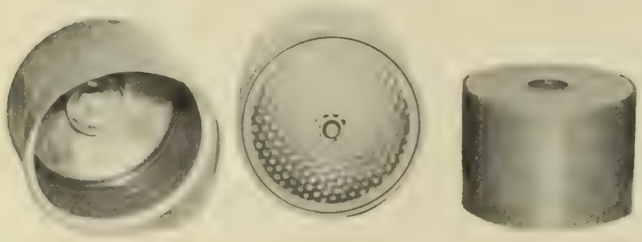
The rotating bomb bay door makes a high speed bombing run possible.



Left, on the RB-57, the observer enters through the access door on the right side. Below, the B-57B, designed as a night intruder, is used also in close ground support.

LONG LEAN and *Lethal*

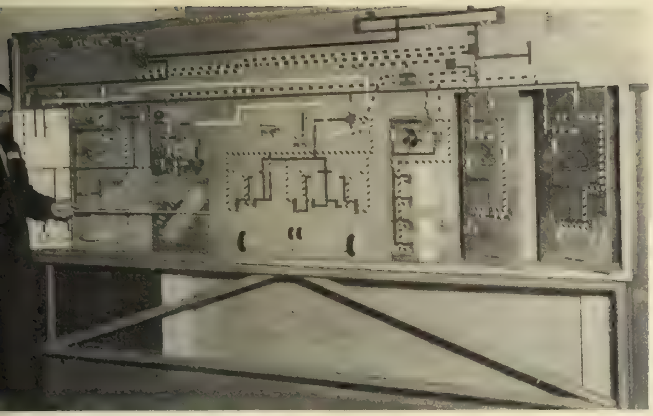
Slow-burning powder and a metal casing comprise the starting unit.



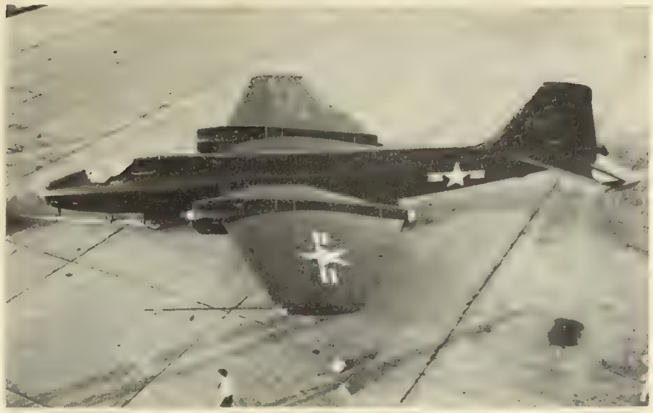
We believe the story on the preceding pages describing the B-57B and what it can do is of special interest to our readers. The aircraft is one of the latest in the U. S. Air Force's stable of combat planes, and while its progenitor, the Canberra, is fairly well known, the B-57B has so many modifications that it is, for all practical purposes, completely different. FLYING SAFETY, both through the article and the extensive picture coverage, is publishing for the first time the full story on this aircraft and how it is being phased into the Tactical Air Command.

A written checklist is followed during the walk-around inspection.

Lightweight screens protect the engines from foreign object damage.



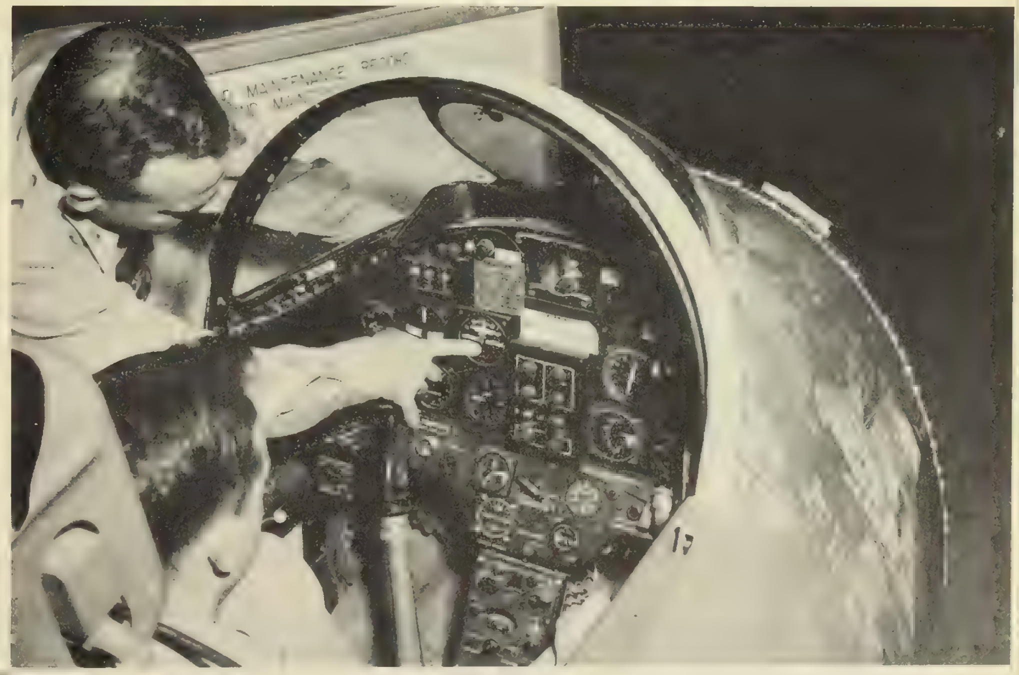
B-57 hydraulic system is illustrated through a training aids panel.



The RB-57 has a smaller canopy that covers the pilot's cockpit only.

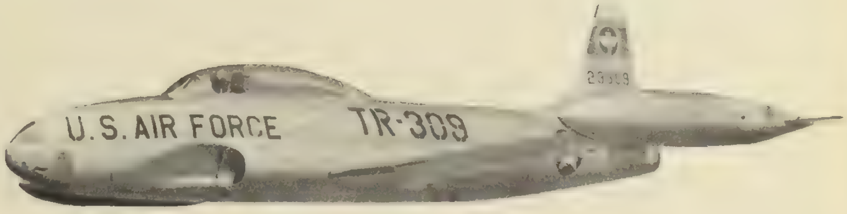
The underslung design of the aircraft creates an illusion of taxiing in a nose-low attitude.

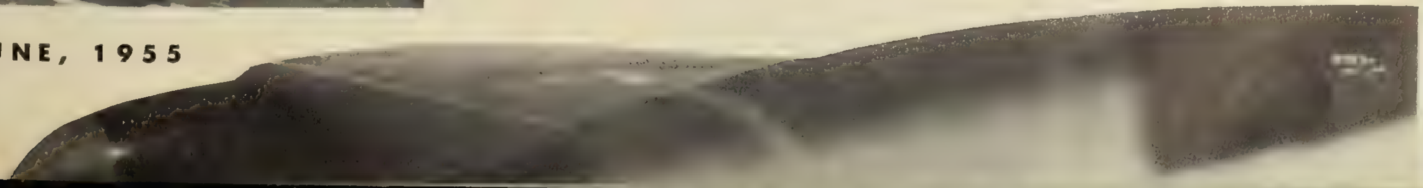
A careful check of the liquid oxygen system must be made during walk-around inspection.



Students learn proper procedures in a T-33 cockpit trainer before starting transition.

Each pilot must qualify in a T-33 for the standard Air Force instrument certificate.





Keep Current

NEWS AND VIEWS

It Listens — Speaking of tow-targets, have you ever thought of *listening* to how far you miss the target? Sounds crazy but one of the latest tow-target systems now undergoing tests does just that. It is known as the Accoustical Firing Error Indicator. This system "listens" for near misses, measures the distance and angle, and passes this information to the ground by means of a telemetering link, thus allowing engineers to make necessary modifications and adjustments to the fire control system undergoing tests.

That's right, in this case it's the fire control systems that are out for high scores instead of you. Tow-targets of today must not only be stable and able to withstand high speeds but must also be capable of carrying any one of a number of "miss" distance indicators. The old targets only indicated the "hits," whereas the new targets not only indicate the "hits," but also show how far the target was "missed" on firing runs.

In earlier air-to-air combat training, a slow, cumbersome canvas "sock" was towed behind the tow aircraft. The fighter pilots would make passes at the "sock" and their accuracy was determined simply by counting the holes in the towed target. While this improved the fighter pilot's marksmanship, it did not aid in improving the fire control systems. The old canvas and cheesecloth tow-targets are being replaced by tow-targets capable of speeds of more than 600 miles per hour. High-speed targets of this type are essential in the engineering and testing of the complex fire control systems of modern aircraft.

Engineering testing of the tow-target development program is carried out at ARDC's Air Force Armament Center, Eglin Air Force Base, so that the expensive and highly complex fire-control systems can be given the final controlled tests before becoming operational.

★ ★ ★

Navarho—Far ranging jet aircraft will receive extremely long range navigation aid from an experimental radio station currently being tested. The station is the first of its kind and the long range system is called Navarho. The station will beam information 2500 to 3000 miles in all directions.

Navarho is designed to supplement the short-range airways stations that criss-cross the country. A single Navarho station can cover an area bordered by the West Coast of the United States, the Azores in the mid-Atlantic on the east, the Artic Ocean on the north and the Gulf of Mexico on the south. An aircraft flying at high altitudes, above that normally used, can fly from the West Coast to the Azores without retuning the radio equipment. For an aircraft travelling 600 mph, this would be guidance for a flight of five hours.

The Navarho station feeds continuous information to the pilot, telling him whether he is east, north, south or west of the station and how far he is from the station. A

This newly designed high-speed tow target is required to test the fire control systems of present day complex, supersonic interceptors.

The new C-119 cargo door can be opened to meet a variety of inflight situations and is a marked departure from standard design.

plane 1000 miles away will receive information accurate to within 10 miles in any direction. Navarho will direct a plane to a point 100 miles from its destination, where it can pick up a short-range station for normal letdown and landing purposes.

★ ★ ★

Three Drones—Three unmanned QF-80 drones were exposed recently to close-in effects of a major atomic blast at the Nevada Test Site. These were F-80 jet fighters, fitted with robot command guidance systems.

During the tests, one drone was lost on takeoff but was replaced immediately by a stand-by. Three separate formations were flown. Each consisted of one drone with two DT-33 director aircraft and two chase planes. One of the chase planes had the function of photographing the drones to record damage or other effects which occurred during the operation. The director aircraft controlled the drones during the takeoff and flight to and from the orbit area. Each DT-33 carries a remote control pilot to control the drone and a pilot to fly the director aircraft. Only one director craft controls the drone, with the other for emergency stand-by.

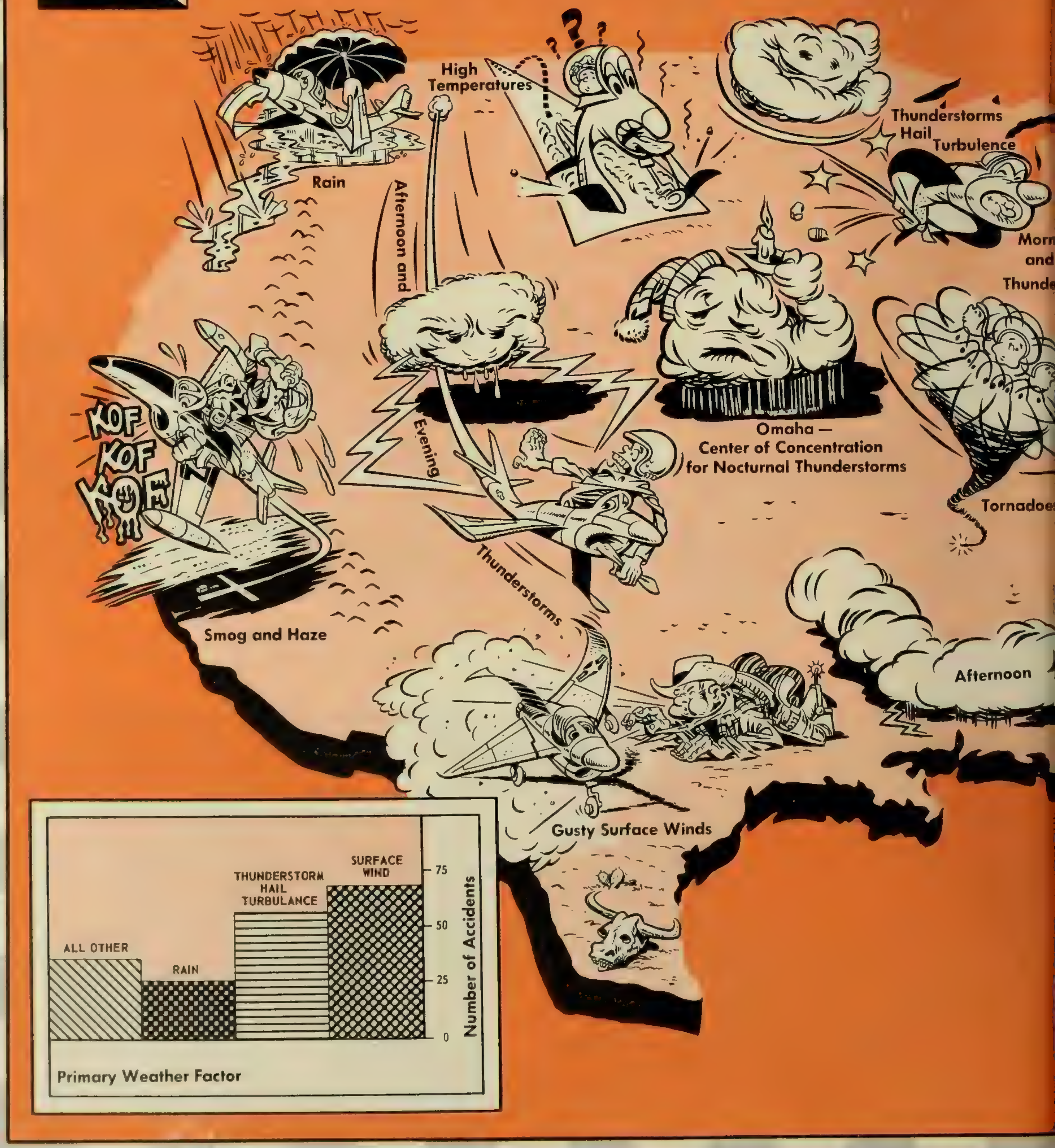
When the formation reached the orbit area, three ground radar operators assumed control so that the unmanned jets could be properly spaced before arriving at assigned air positions. After transfer of control the director aircraft proceeded to a holding point several miles from the blast to pick up any of the surviving drones. If a drone is destroyed, special data-collecting equipment is jettisoned by radio command from the director and helicopters spot and recover the equipment.

All three drone aircraft survived the immediate blast effects; however, two of them were severely damaged. One was crash-landed on a dry lake bed by its director aircraft. The other damaged drone crashed in the mountains. The third was landed successfully.

Four production models of the B-47 are shown in a "family portrait." Newest of the series is the RB-47E photo recon, shown at far left.

A runway controller flies the QF-80 off the runway, then a DT-33 director aircraft controls it to the orbit area, and a ground radar controller directs the pilotless aircraft through the atomic cloud.

Summer Flying Haza



THE GOOD OLE SUMMER TIME is just around the corner and everybody knows that's the time for blue skies and balmy breezes. SURE it is! But lest you forget, you're still in the flying business and woe to the birdman who sells short the many summer flying hazards.

Weather elements that are most often cited as contributing causes to summer aircraft accidents are thunderstorms, hail, rain, surface winds and turbulence. A by-product of one or a combination of these phenomena that has caused its share of grief to the unsuspecting, is blowing dust.

Thunderstorms will be found over the states bordering the Gulf of Mexico and over the Ohio, Missouri and Mississippi River Valleys. They are also prevalent along the eastern edge of the Rockies with gusty surface winds in Texas.

We must also consider low ceilings and visibilities. The New England and Mid-Atlantic coasts, the Seattle area and the coastal region of Southern California around Los Angeles will have lots of that type of weather. The hours from midnight to 0900 will be the time of most frequent occurrence. Certain industrial regions in the Ohio River Valley are also susceptible to these foggy conditions.

Just for the record, it seems that the Great Plains States from Texas to Canada have the most "weather" accidents during June, July and August. Fifty-six per cent to be exact. The region west of the Continental Divide reported only nine per cent and the balance of the nation reported the remaining 35 per cent.

The accidents discussed in this article are those in which weather was a contributing factor. In only 27 of the 194 cases was weather the primary cause and 25 of those cases involved thunderstorms or their offspring.

Most pilots believe that the old thunderstorm is the greatest contributing factor in summer accidents. 'Taint so. The seemingly inoffensive surface wind was the villain in 68 of the 194 summertime weather factor accidents. Sixty per cent of those were in the Great Plains States, with Texas alone reporting more than 25 per cent of the "wind" mishaps. An interesting, though distressing, offspring of gusty wind conditions is undershooting. Heretofore, gusty winds accounted for the wing drags and groundloops and only recently have we been confronted with this undershoot problem.

The majority of accidents caused by thunderstorms and associated weather occurred in the Great Plains States. About 60 per cent of the accidents attributable to thunderstorms have happened in that area. This figure probably reflects the fact that almost all pilots are familiar with the frequent occurrence of thunderstorms over the southeastern part of the country. However, most drivers are relatively ignorant of the fact that these storms occur with equal frequency over the prairies and along the eastern edge of the Rocky Mountains. Knowledge makes them reluctant to fly into the southeast during thunderstorms season. Lack of knowledge results in having no qualms about flying over the Plains States. It is simply a case of not foreseeing the true picture and therefore not being prepared to meet it.

Rain is another hazard, accounting for 33 of the 194 weather accidents. Wet runways, rain-blurred windshields and other obstructions to visibility were the direct causes most often cited. More than half of these accidents occurred east of the Appalachian Mountains.

Always a problem in summer, particularly to jet pilots, is the effect of high temperature on air density, which in turn greatly affects the takeoff roll of jet aircraft. A condition of high temperature and low air density can exist anywhere in the nation. So, check that takeoff roll carefully because the combination of heat and high field elevation can really be hairy to the unsuspecting pilot.

And now a word of warning. The facts and figures presented are based on past occurrences and averages. We have outlined the areas of maximum occurrence of certain weather elements. However, under certain conditions, any element could be encountered over any portion of the country. To plan your individual flights, check with the forecaster at your local station. He has the latest information available and will do his best to help you. ●

"I am really interested in helping you get the word around concerning your latest near-miss. It helps everybody when we share our experiences. So, send me those near-accident reports. Remember, they will all be treated anonymously."

REX SAYS:

Major Rex Riley, the well-known aircraft accident investigator, switches his attention to the accident prevention phase of flying safety. He is interested in pointing out that as a direct result of operational hazard or near-accident reports the Air Force has taken a big step toward preventing avoidable aircraft mishaps.

This reporting system is in effect within several major commands and many base Flying Safety Officers have started their own programs too. The value of reporting a situation that ALMOST resulted in an accident is quite obvious.

The problem is to encourage personnel to submit near-accident reports thus assuring proper action. Rex feels that one way to round-out the appropriate action phase is to send the reports to him. He will review them and you can read about the pertinent trends and information in his special REX SAYS feature.

I HAD AN experience recently that points up what can happen when an instructor loses his temper with a student and attempts drastic corrective action.

We had been unable to fly for nearly a week because of the weather and this ride was to be a pre-solo transition mission in a T-28. It was the student's fourth ride, and all presolo requirements had been fulfilled.

His last flight had been unsatisfactory because of poor preflight planning and poor traffic patterns. The student's difficulty had been a slightly diving final turn, although his general pattern and airwork were considered satisfactory.

After takeoff, we stayed in the pattern and shot six landings. The student seemed to be doing well, so we flew to the acrobatic area and spent 20 minutes on acrobatics. We then returned to the field and the student entered the traffic pattern again.

I noticed that the student was delaying his pitch slightly and was flying too long on the downwind leg. After talking him through several more patterns, during which he failed consistently to shorten the length of the downwind leg, I took the controls and demonstrated another pattern.

On the student's next pattern, he delayed his pitch slightly and rolled out on downwind at 1500 feet. He dropped the gear and then the flaps; at this point I became overly irritated at his failure to turn onto base and kicked hard right rudder and fed in aileron and back pressure to start the turn. The airspeed was approximately 105 to 110 knots.

The aircraft immediately snaprolled to the right, went inverted in a full stall and continued to rotate. I told the student that I had the plane, added power and released some of the back pressure, attempting to get the aircraft flying again.

After the first roll, I still didn't have enough control to stop rotation, and the plane remained in a stalled condition. During the second roll, the aircraft started to come out of the stall. I finally got enough aileron control to stop the roll at the bottom, but the plane didn't stop shuddering until I released still more back pressure.

It appeared at this time that I would touch down, but we cleared the ground and slowly climbed out. I don't remember just when I pulled up the gear, but it was up after I had recovered from the rolls.

It goes without saying that I intend to play it cool in the future; I'll be the sweetest-tempered instructor in the Air Force, bar none.

— — —

REX SAYS: *This lad learned a lesson the hard way, but all in all he came off remarkably well — and has the good grace to pass his learning on. His mistakes are obvious; no student can learn when his instructor loses his temper, and today's big birds aren't designed for manhandling close to the ground by any pilot in a fit of pique.*

★ ★ ★

RECENTLY, I HAD several experiences that I believe will be of value to your readers. In the first instance I was taking off an F-84D when the entire cockpit became flooded with such a dense accumulation of vapor that it was almost impossible to see the instruments. The weather at the time was restricted visibility with a 250-foot ceiling.

The vapor was caused by very high outside humidity, and formed suddenly, without warning, just as the wheels left the ground. My first reaction was to try brushing the stuff away from the flight indicator and airspeed indicator. This was strictly a losing battle and I then flipped the cockpit pressure switch from PRESSURE to RAM. This dispelled the fog immediately and I was able to see my instruments satisfactorily.

Hereafter, on takeoff in this aircraft under such conditions, my own solution is to place the cockpit pressure switch in RAM position before takeoff and leave it there until I reach a comfortable altitude.

The second incident happened several days later while I was giving an instrument check in a T-33. I believe this could have been very serious under actual weather conditions.

The student was making a standard jet penetration and low frequency range approach on an Air Force base. He had completed his penetration over the homer and had taken up the correct outbound heading of 035 degrees on the slave gyro, going to the low cone of the range. However, instead of being on a heading of 035 degrees he actually was on a heading of 080 degrees. Sometime during the penetration the slave gyro, with no warning or indication, had gone out of phase by 45 degrees.

REX SAYS

I found that once this situation is known, it is a simple matter to make the appropriate corrections. In this case, the student made two more penetrations and low approaches with the instrument 45 degrees off. The danger lies in not knowing the instrument is out of phase, and in which direction it is off. I feel that it is very advisable, when flying under instrument conditions, and particularly during the letdown and landing phase, to cross check the slave gyro against the standby magnetic compass whenever the aircraft is in a level flight attitude.

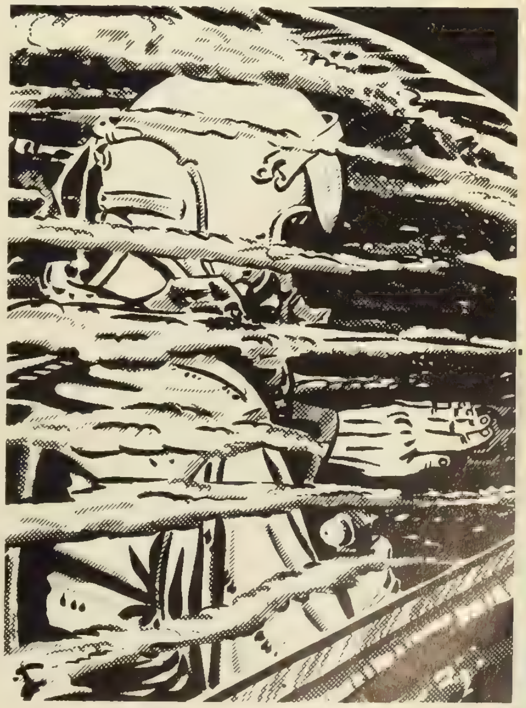
— — —

REX SAYS: *The recommendations and comments on these two incidents make a lot of sense.*

One thing in the F-84D incident does occur to me. Wonder why the fog didn't show up in the pre-takeoff check at 100 per cent?

Cross-checking, while on instruments, is always important, and checking the slave gyro against the standby magnetic compass in level flight sounds like one of those kind of tips that pays dividends.

"...brushing the fog off was a losing battle."



REX SAYS

I WAS FLYING a night 60-2 mission in the front seat of a T-33 with another pilot in the rear. We has just completed a practice GCA final approach with the pilot in the rear seat flying under the hood. Both GCA controllers at this time sounded very clear and capable except for having told us at two different points to descend to 1500 feet. After adding power to go out for another approach the final controller told us to take up a heading 050 degrees, 2000 feet and contact search control. We did this and search control said that he had us on his scope and told us to maintain a heading of 050 degrees and hold 2000 feet. Approximately one minute later the controller instructed us to turn left to 260 degrees and maintain 2000 feet.

During this interval we clearly heard the controller directing at least two other aircraft. We turned to 260 degrees holding 2000 feet. We were intermittently in the clouds. While flying in the clouds, approximately a minute later, my oxygen mask became completely plugged. I told the pilot in the rear seat that I was loosening the mask to unplug it. As I was looking down into my mask, movement below the left side of my canopy caught my eye. It was very dark and poor visibility downward, but I suddenly realized that there were bushes about 300 feet below us and that the ground was rising very rapidly. I jerked my head forward and saw only black, but at 11 o'clock high through the haze I could make out some sort of building or towers, which I suddenly realized were on top of a mountain ridge or crest. I grabbed the stick and pulled back. We were making about 250 knots and as I pulled 5G, putting the aircraft in a shudder, I saw the face of the mountain in front of us. I clenched up, waiting for the crash and from what I could determine from the side of the cockpit, the aircraft passed upward parallel to and within a few feet of the face of the mountain. As we headed skyward, we passed below and to the side of the buildings on the hill which means that we were apparently in some sort of draw. We recovered partially in the clouds and headed back to the base and landed.

We informed GCA immediately that we almost hit a mountain, and the controller said that he believed that our receiver must have been out and to turn left to 230 degrees. Considering our position, I am sure that the controller did not have us on his scope and that the unit was trying to handle more aircraft than it was capable of handling. At no time was our receiver quiet for more than a very few seconds and transmissions to all aircraft were clear and distinct. At no time was there any indication of radio failure. On the ground it was determined that we were heading toward an 8000-foot mountain.

I am convinced that no accident was ever more certain or close without actually occurring and that only through the Grace of God was it averted. Amen!

REX SAYS: *There are two things to be considered here. The first involves the GCA controller. That the controller should have directed the aircraft to another heading, provided he had radio contact, is obvious. If GCA had so much traffic that they could not adequately handle it, the fix here is also obvious. Granted, the facts available indicate that GCA goofed, but let's hit on the second point. The pilot flew in a GCA pattern for more than one minute without receiving any transmission from GCA. It must be remembered that, regardless of the reason, if you do not receive transmissions for any 30-second period (or as specified in the GCA emergency instructions) while in the GCA pattern or for any five seconds while on final, execute that missed approach procedure.*

This is probably the hairiest near-miss I have ever read. The pilot's comment about it being so close is the understatement of the year, and I'm with him when he says AMEN!

". . . I saw the face of the mountain in front of us and clenched up, waiting for the inevitable crash."

Nothin' ever happens to me!

too bad he didn't read this article before takeoff!

Col. Harry G. Moseley, USAF (MC), Chief, Medical Safety Div, D/FSR

IF YOU ARE A member of the "It-can't-happen-to-me" school, listen to this. What happened to the particular pilot we are about to describe could happen to anyone and, except for the fact that he had taken a few fortuitous precautions, this announcement might have appeared as a statistic rather than a story.

The episode was relatively simple and completely unexpected. He was cruising along in his fighter at 33,000 feet, with a cabin altitude of 14,000, at 280 knots indicated. The morning was bright, fuel was no problem, destination was clear and all was well with the world. Then suddenly something happened.

There was a resounding crash. The cozy cockpit changed to a howling environment of terrific and icy wind. The pilot's vision was blotted out. It was upsetting.

After a moment some semblance of composure was regained and he found he was still in level flight and that the merciless pummeling he was receiving from the cold air was the result of the unanticipated and unannounced departure of his canopy. Further, he discovered that his loss of vision was due to the fact that the windblast had pushed his oxygen mask up over his eyes. So here we are at 33,000 feet, cruising at 280 knots indicated, pulling our oxygen mask down over our nose, being blasted by an 80-degree-below-zero slipstream, and studiously announcing "MAY DAY!"

It is appropriate to observe that he was able to make such an announcement because he was still equipped with microphone, mask and protective helmet. This is of more than casual interest. The same windblast that raised his mask over his eyes did its turbulent best to snatch his mask, helmet and all and remove them permanently from his possession. Had he not had his chin strap well fastened, he would also have been dependent on near oxygen-less air for his continued survival. How long is useful consciousness at 33,000 feet? A little over 30 seconds!

However, being still connected to the ship's oxygen supply, he was able to think, so he quickly decided to leave this high, frigid and inhospitable environment and seek some more friendly territory, say around 10,000 feet or thereabouts, until a landing field could be found. The latter point, too, was a matter of slight concern since a quick inventory revealed that all maps, charts and similar aids had chased out after the canopy, to assist we presume in celestial navigation.

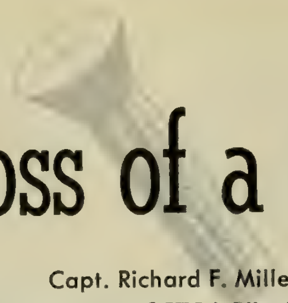
Here entered another surprise. As soon as the nose was lowered, the speed picked up, and noise, air blast and buffeting became so insultingly painful that higher cerebral authority immediately issued a cease and desist order. The pilot found that the maximum descent he could maintain was a few thousand feet per minute and the maximum speed 250 knots.

Even this descent had to be periodically interrupted with a bit of level flight to keep matters within the limitations of his tolerance, and to give him time to place a near frozen hand or toe briefly in front of the heater duct. Of course, if he had dumped his dive brakes and chopped his throttle, he undoubtedly could have come down much quicker. Yet, it is only fair, in view of the circumstances, to allow him a bit of confusion.

Here enters another observation of some importance. The cold of the upper atmosphere is a nasty character with little or no regard for the fraility of human flesh. Thus during the entire descent there ensued a running battle between the thrusts and parries of frostbite and the defense and evasion of the pilot. As luck or destiny (or foresight?) would have it, the pilot was wearing, in addition to his regular clothing, a B-15 flying jacket, a scarf, gloves with liners and two pairs of heavy socks under his flying shoes. This undoubtedly won the battle for him. The only wound that frostbite inflicted was one small nip on the heel.

Eventually reaching an altitude of approximately 10,000 feet and relatively warm air of approximately zero, the pilot was able to orient himself, find a suitable air base and make "an uneventful landing."

It might be concluded that a fastened chin strap and sufficient clothing are handy antidotes in combating the celestial alchemy which would lure us to hypoxic oblivion or reduce us to popsicles. And for the benefit of the "It-can't-happen-to-me" boys, it might be added that the loss of the canopy was due to a small error in maintenance. ●



For Loss of a Bolt . . .

Capt. Richard F. Miller
Flying Safety Officer, 3575th Pilot Training Wing
Vance Air Force Base, Okla.

Here is an outstanding example of what can be accomplished through an efficient, highly organized flying safety program.

In this particular incident, Capt. Miller's effective "near-accident" reporting system, his close liaison and personal knowledge of the pilots in his organization and his aggressiveness and determination to "get the job done right," enabled him to discover the true cause of a major accident. His efforts uncovered a hitherto unsuspected defect which could affect the control system of B-26 aircraft.

In recognition of his fine work, Brigadier General Joseph D. Caldara, Director of Flight Safety Research, Deputy Inspector General, presented Capt. Miller with a letter of commendation. The following excerpts from that letter speak for themselves:

". . . Captain Miller, Wing Flying Safety Officer . . . by his aggressiveness and initiative, brought a B-26 design deficiency to light that will, in all probability, save the Air Force valuable lives and equipment resoures.

". . . persistent individual interest and desire to improve the Air Force situation is extremely laudatory.

"Captain Miller is commended for his demonstration of the outstanding qualities desired in a Flying Safety Officer. Only by such searching analysis and investigation can we achieve our goal."

SOMETIMES I FIND the role of Flying Safety Officer to be much more than just an interesting assignment. There are times when I wish that I had a bit of second sight. Sure, I know that the FSO is a guy well versed in all phases of accident investigation and has most of the answers on the prevention end of the business, too. Once in a while, however, you run up against a blank wall.

Recently I did a lot of head-banging on that proverbial wall, and for a while all I got for my troubles was lumps. Ever have that happen to you?

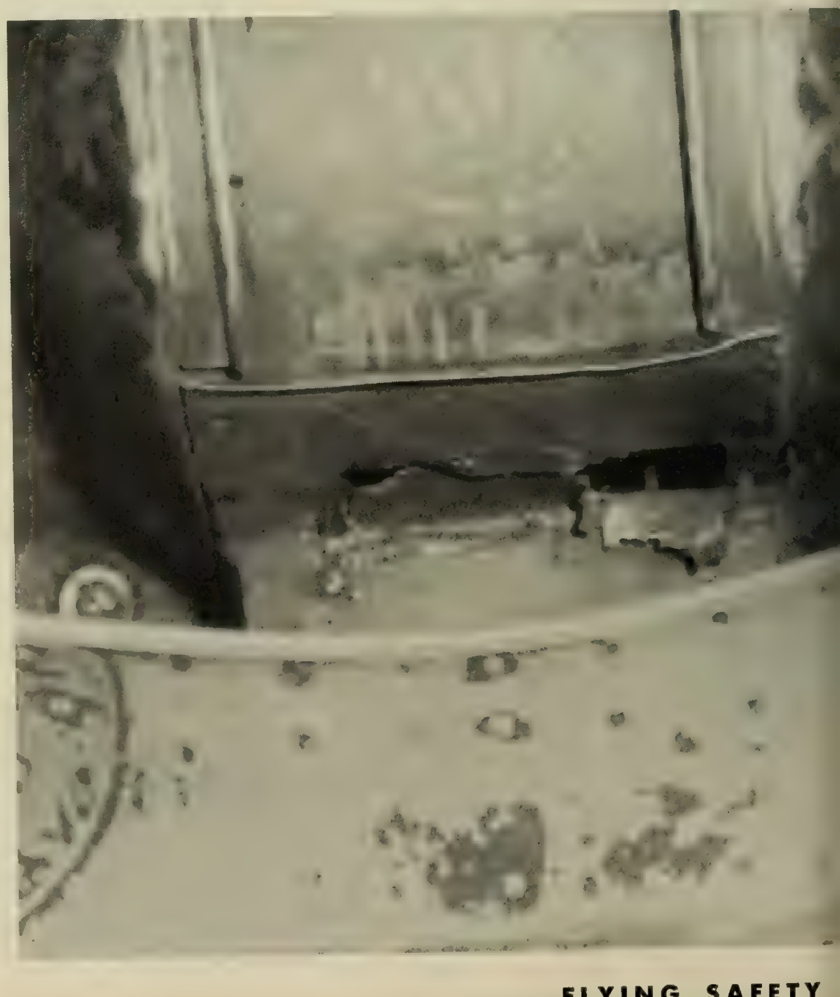
We lost one of our B-26s one day. The aircraft was scheduled for a round-robin navigational proficiency flight but the IP scrubbed the mission after receiving severe weather warnings and decided to fly local for several hours. The crew shot a normal landing at an auxiliary field late in the afternoon; this was the last radio contact with the B-26.

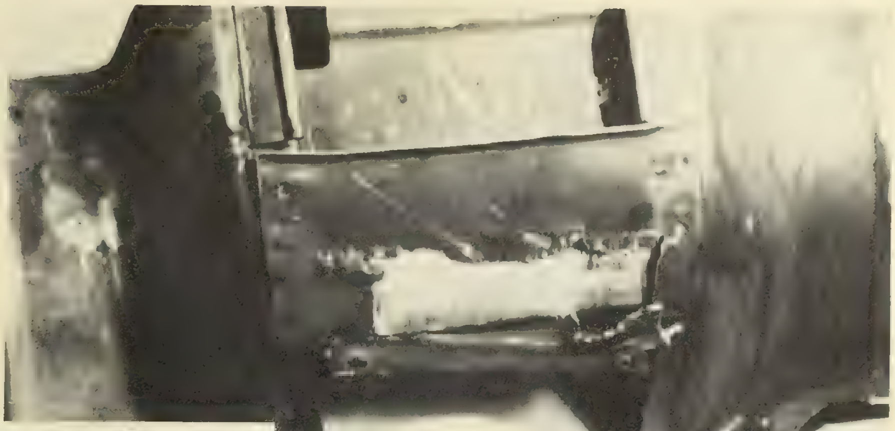
Upon being notified of the crash, a convoy proceeded from the base to the scene of the accident. The plane had crashed at a high rate of speed in a rough pasture. Witnesses stated that the B-26 was flying about 2000 feet above the ground, entered a fairly steep bank, lowered the nose in the turn and rolled out in a diving attitude, with the wings level. They agreed that the plane had almost leveled out prior to impact.

Investigation confirmed the witnesses' statements. The aircraft had hit in an almost level attitude at 300 mph, with normal power on both engines. An obstruction on one end of the field enabled us to determine that the minimum glide angle of the aircraft must have been at least 17 degrees. Exhaustive examination of the wreckage failed to turn up any evidence of materiel failure or mechanical malfunction. After reviewing all the evidence compiled, the accident investigation board determined that the aircraft had been engaged in a simulated gunnery pass and that the pilot had misjudged his elevation and initiated his pull-out too late.

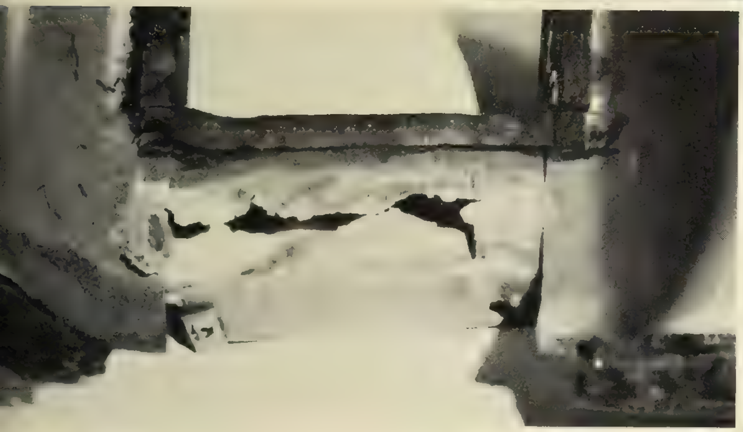
For all of our digging and recon-

The combined strength of the two pilots was necessary to move the jammed control from neutral and force its cover through the tough metal torque tube assembly cover.





Right, external view of how the cover of lower end of control column came through the casing.



Torque tube assembly, shows the damage inflicted when lower cover was forced through.

structing and analyzing we still arrived at but one solution — "Pilot Error." Believe me, I hate to use those words. In this case especially, they just didn't ring true. Yet, we were faced with almost irrefutable evidence that an experienced instructor had violated some of the basic principles of recognized flight procedures.

With the board findings completed and the accident report forwarded to higher headquarters, I suppose the logical thing to do would have been to forget the whole affair. Possibly I'm not logical. I couldn't forget it and in spite of my common sense, I couldn't reconcile the board findings.

Understand, when I say that, I'm not implying that the board didn't do a good job. They did as well as any group of experienced personnel with the information available.

Approximately one month after the accident, we had an incident occur that involved a thoroughly qualified instructor pilot and student. When I use the word incident, I do not mean the reportable kind as spelled out in AFR 62-14 but rather a near-accident. Another B-26 was mixed up in this one and we nearly lost it.

Briefly, this is what happened: Early one afternoon an IP and a student took off on a routine training flight. As the aircraft was climbing out, the instructor noticed that the right engine oil temperature was running high so he canceled the mission and re-entered traffic.

The surface wind was beginning to kick up quite a bit at this time, with gusts up to 35 knots, so the IP decided to land the plane himself. He turned on final with the airspeed pegged at 150 mph and flaps down 38 degrees.

Nearly down on the deck, the pilot eased off on power and started to apply back pressure for the flareout, and at this moment he knew that he was in trouble. The controls felt jammed. He couldn't move the yoke back and the runway was coming up at an alarming rate.

He immediately let go of the throttles and got both hands on the control wheel. A quick glance assured him that the student was not touching the controls, and then with all of his strength he heaved back on the column. At the same instant, the student realized the instructor was having trouble, and he added his strength to the tug-of-war. This was fortunate, for their combined tugging gradually deflected the elevators enough to get the nose up just a bit, and with a spine-jarring slam the B-26 hit. The nosewheel contacted the runway first but luckily was not sheared. As the main wheels touched down, the pilot got on the brakes and brought the plane to a successful stop.

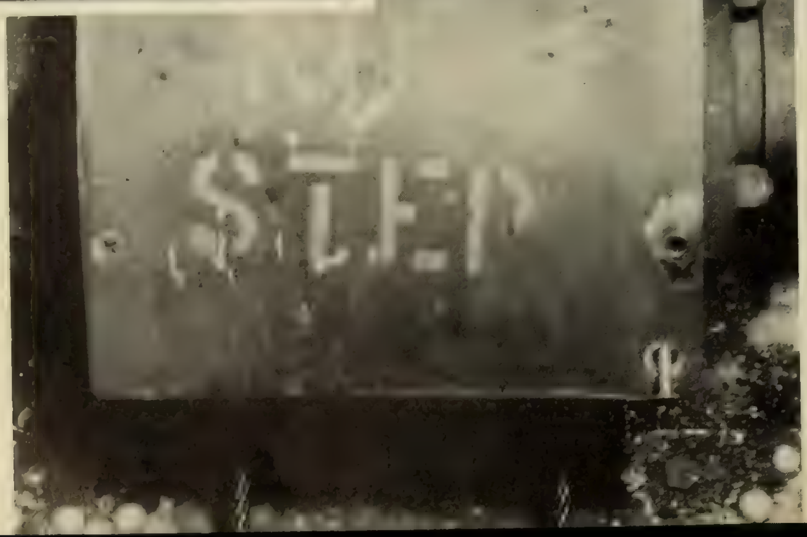
Inasmuch as this could hardly be classed as a normal approach and landing procedure, both pilots were, to coin a phrase, "just a bit shook" and immediately taxied the plane to the ramp and shut it down. Then they came directly to my office to report the incident.

I went back down to the line with them and we checked over the B-26. What had happened really was fairly simple. One of the screws which holds the cover on the lower end of the pilot's control column had come out at some time or other. The cover had worn a groove in the rear chaffing plate of the control torque tube cover. When the instructor pilot had attempted to flareout on the landing, the control column cover had jammed into the groove, causing the controls to bind in a nearly neutral position. The two pilots, both big men, had overcome the binding by application of a lot of muscle. The fact that the aircraft was in a shallow angle descent, using only 38 degrees of flaps, was another big reason why there was no major accident.

Anyway, that's how we had it figured then. Further analysis proved we were right.

Well, right away bells began ringing in my head about that "pilot error" accident that had been on my mind for the past few weeks. Maybe this incident was an identical case, but with a happier ending. I was anxious to find out.

The pilot who had just reported the incident had been assigned another B-26, and I suggested that he put his fingers on the control cover and move the controls to see if he could feel any grating or grinding in the metal. Sure enough, he found that the same situation existed on this aircraft as on the one he had just landed.



Left, shows how the bolt backed off of lock nut. Below, cover plate removed exposes the critical area where loose bolt caused the jammed control.

I went to look for the maintenance officer and brought him back out to the flight line with me. Then I reported our findings to the chief of maintenance and recommended that we conduct an immediate, one-time inspection of all of our aircraft and that an emergency UR be submitted.

The up-shot of our one-time inspection was that we found three *additional* aircraft with exactly the same discrepancy—the screws at the bottom of the control cover plate for the lower end of the pilot's control column were loose, so that the cover plate was wearing against the torque tube cover.

By this time I was convinced that the cause of this incident was also the cause of the accident that had happened a few weeks before.

All of this occurred on a Friday afternoon. Early Monday morning we began sifting the wreckage of the crashed B-26. We found only about 40 per cent of the control column assembly and torque tube covers, but we did find the bottom of the pilot's control assembly. And the screw which was missing on the B-26 involved in the incident on Friday also was missing from this cover.

There was no one at our base with enough specialized knowledge to tell if the screw had been out at the time of the crash, and we were not even certain that the missing screw could have caused the accident. Our Wing Commander decided that I should visit the San Bernardino Air Materiel Area and possibly the Directorate of Flight Safety Research with my evidence in order to obtain a qualified opinion as to whether we had uncovered the cause of the accident.

The conclusion was that the accident had been caused by the screw backing partially out. Our opinion that the loose screw had permitted the cover plate to come away from the edge of the casting was confirmed. The freeing of the cover plate then permitted the control column cover to enter this space and jam up against the screw, restricting elevator travel. It was further concluded that the screw had finally pulled out all the way during the disintegration of the aircraft on impact.

And so the original "pilot error" label on the accident has been changed.

The San Bernardino Air Materiel Area has issued a Tech Order requiring a one-time inspection similar to the one we pulled at our base, and there is also a fix requiring that bolts with self-locking nuts be installed on that control column cover.

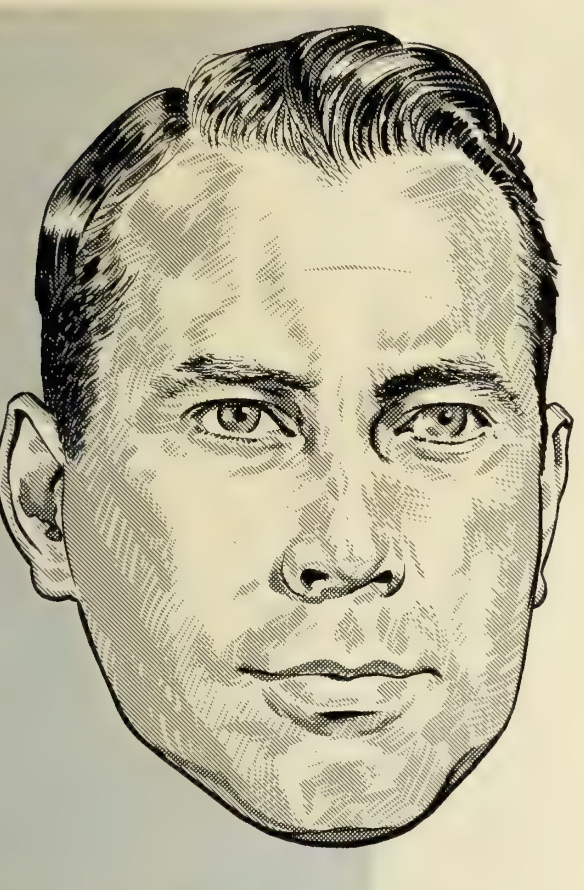
To my mind, this whole business shows how vital near-accident reports can be. If the pilot who experienced the control trouble that Friday afternoon had not bothered to report the incident to me, that aircraft could have been repaired and returned to service without anyone knowing about the problem except the maintenance man who did the repair work.

In that case, the investigation which we conducted would never have been made, and we would never have known the real cause of that B-26 accident. And, carrying the thought a little further, those other aircraft which had the same discrepancy might have ended up as "pilot error" statistics, too.

Intuition or sixth sense or whatever you want to call it had told me there was more to that first accident than we had uncovered. But I would never have found the real answer if that IP and student hadn't taken the trouble to report their near-accident that day.

This incident clearly shows the value of a written near-accident report. Most commands now have a standardized form for such reporting procedures. And, only by complete dissemination to all agencies concerned can we hope to prevent recurrences of incidents of this sort.

The old saw about forewarned is forearmed certainly applies in our business. The near-accident report form and emergency UR are the tools to fight and lick almost any aviation problem. ●



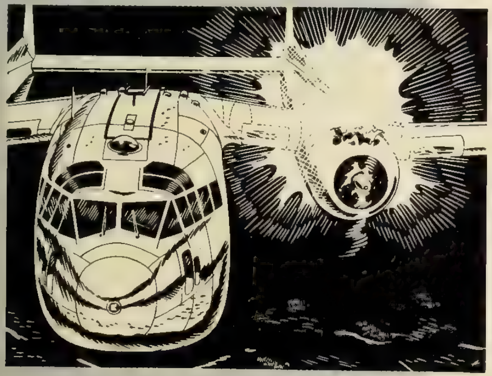
WELL DONE

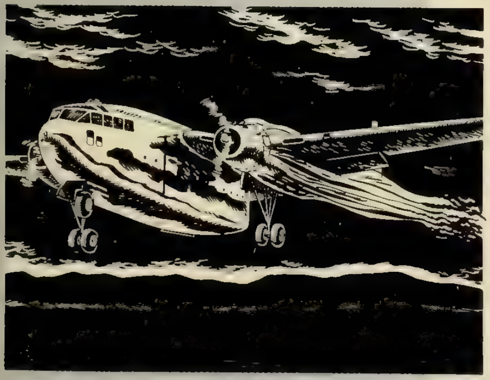
Captain

L. S. Thompson, Jr.

6614th Air Transport Sq.
Ernest Harmon AFB, NEAC.

the Number One engine exploded suddenly."





with one burning, a straight-in was made."

CAPTAIN LESLIE S. THOMPSON was flying a C-119 from Torbay Airport, Newfoundland, to Goose Bay, Labrador. Shortly after takeoff the oil pressure of the right engine dropped to 15 psi. The aircraft was leveled off at 3000 feet and power on No. 2 was reduced. The cylinder head temperature moved toward the red and as the engine started to backfire, Captain Thompson shut down and feathered the propeller.

The aircraft was immediately turned back toward Torbay and GCA was notified of the emergency. The weather at takeoff had been 300 feet and one mile and GCA had been tracking the aircraft during the takeoff and climb.

As soon as the 180-degree turn had been completed the top cylinder on No. 1 engine suddenly exploded and the torque dropped approximately 50 per cent. With 19 passengers and a load of cargo, the aircraft began losing altitude immediately. Captain Thompson quickly unfeathered the right engine and put it into operation with only partial power available.

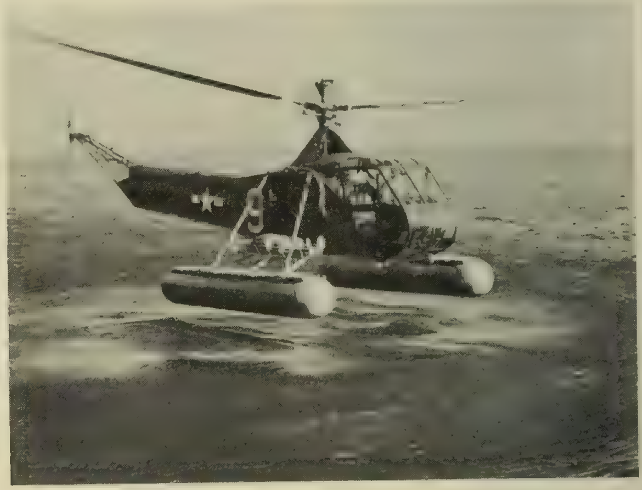
GCA brought the aircraft on to a long straight-in approach and with the left engine on fire the aircraft broke out of the overcast.

Captain Thompson managed to complete the approach and skillfully landed the aircraft without further damage.

The outstanding flying ability and excellent judgment displayed by Captain Thompson are a credit to himself and to the United States Air Force. WELL DONE!

It's better when you help—

It is important to get in that sling correctly. It's a long way down.



Rotor downwash tends to hold life raft under chopper. Stay with it.

IN CONCENTRATING on his own machine and all that goes with flying it, the average "fixed wing" pilot has given little if any thought to his plane's cousin, the rotor bird. This breech of family etiquette may go unnoticed for an indefinite period. On the other hand, it could be brought into sudden focus at a time when formal get-togethers would be about as appropriate as a pair of water wings at a roller derby. Or, don't you think that the moment of rescue would be a rather late date to be finding out about the tricks of the trade?

Of course in this event, cousin whirly would do all that he could to make up for your past indiscretions. The success of these overtures of goodwill would depend entirely upon him, for you see, he would have a much better view of the situation than you. To be more specific, just about 100% better because he would be looking down on the problem from about 25 feet or more.

One estimate puts the number of lives saved by helicopters in the Korean fighting at more than 7000. Some of the rescues were routine, some exciting, some were accomplished in a matter of minutes and others took days of thought and planning. However, for the helicopter rescue pilots, business—the life-saving business—has been good. The stump jumpers have been hard at work.

Regardless of their work and countless successful saves, too many downed pilots did not know how to help save themselves. They didn't understand how to attract attention. They threw away useful equipment. They did not take proper care of themselves. And most important of all, they did not know enough about helicopter limitations to put themselves in the best rescue position.

This is particularly true of the fellow down there alone, with nothing between him and big trouble but a pararaft and a survival kit. Survivors in groups not only can spell one another, but collectively, they can better figure out the smartest ways to proceed, and thereby help each other out. But the solitary soul, strictly on his own, is more likely to make the kind of mistakes that will preclude a successful rescue.

Having qualified the necessity for a survivor to have a more practical knowledge of his rescuer and his problems, four simple principles are offered which if applied, make for easier rescues.

The four principles are: *anticipate, communicate, prepare for a wait* and *cooperate*. They are as simple as that. To know and practice them will give every pilot and crewmember a much greater chance for survival if the need ever arises.

In survival and rescue, the percentage always favors the man who has figured out some of the answers beforehand. That is, *anticipate*. And, like most preplanning it begins with a book session. A thoughtful look at the many publications on survival will show you what some of the problems are and will help you prepare for them.

Another part of the anticipation principle is knowing the survival gear you carry around with you. The Aero-Med people are old hands in the business of staying alive during emergencies and have included in the pararaft kit as many helpful items as you can conveniently carry around. Break down the kit and take a look. Then learn how you can use it.

While all this may have very little to do with being hauled out of trouble by a helicopter, you can be on hand, ready and waiting for rescue when the whirlybird pilot wheels over the horizon.

Have you been through your bailout routine lately? How about your procedures for an overwater bailout? It's still a good idea to have a set pattern in your mind about when to inflate your life jacket for example, because once you've done it you may not be able to slip out of your harness. The trick is to release your harness before inflating your vest. Old stuff, you say? Sure it is, but some people have forgotten.

The Mark III and IV anti-exposure suits, good as they are, have added a few more complications to ditching. Recently a pilot was forced to ditch and then jumped into the water with his chute still on. The tight leg straps trapped a lot of air inside the suit and he soon found himself floating like a high diver who couldn't recover from a jack-knife—head under and rear end riding high. He had to paddle like mad to keep his head up and consequently could not use his hands to loosen the leg straps. Fortunately, a helicopter was on the spot. After much furious swimming, the ditcher was able to get an arm through the sling, but half way out of the water he lost his grip and fell back in. The second pickup was successful. All this happened in less than five minutes. It didn't help matters either that the rescued man was pulled aboard the helicopter with the parachute and pararaft still strapped to his posterior.

It is recommended that when wearing one of the buoyant anti-exposure suits one should try to squeeze all of the air out of the pants before fastening the leg straps of his harness.

Another thing. Each time you fly, you may suddenly have to become a spotter. If one of your buddies bails out do you know how to keep him in sight? Nothing is easier than to miss practically any object down below. By the time you've turned around your survivor is gone. This can happen on land as well as over water. That is why some squadrons in Korea made a specific effort to train their pilots to keep people on the ground under close observation. They practiced on farmers working in the fields or with their own people posted down there in training exercises. Emphasis was placed on sighting a downed pilot immediately and not looking away until he had been accurately located with reference to landmarks.

What has this got to do with bettering the chances of rescue? Just this; nobody can make up a set of rules as he goes along. The unexpected always happens fast, so prepare for emergencies that may happen to you or your friends. Be ready to help when it happens. Practice sighting objects on land or on the sea. Remember that the helicopter pilots are too visually limited in range to do much wide searching. For them to reach a downed man requires aid. Either through radio contact with the CAP, by mirror or some other signals from the ground.

Next thing on the agenda is to *communicate*. There are many ways for the downed airman to communicate. If you find yourself in the spotter's role, a good position report is a must. You'll see why if you take a look in the cockpit of a helicopter. Navigation instruments are few and far between. Understand also that the pilot is necessarily so busy with his hand and feet that he cannot possibly do much fancy navigating. In combat over enemy territory a helicopter, relatively slow and limited in range, is a hovering duck for small-arms and AA fire, so the whirlybird starts out on its rescue mission with a specific objective. The pilot must know where he is going, and whether he can make it back home. Of necessity a good position report is a must for him.

Give the pilot all possible aid to help him determine the direction of the surface wind.

Naturally communication procedures vary from area to area, but one thing never changes: The necessity for full information about the intended pickup.

In a plane equipped with VHF or UHF radios, you know that your range of communication is limited. At the same time, knowing how difficult it is to keep sight of an object as small as a man, you won't want to go upstairs where your message has a better chance of getting through. You may not be able to locate the survivor again if you do. The best bet is to keep the man in sight, taking a chance on the radio signal. Later, if you are forced to leave without being relieved, gain altitude and send out your signal again.

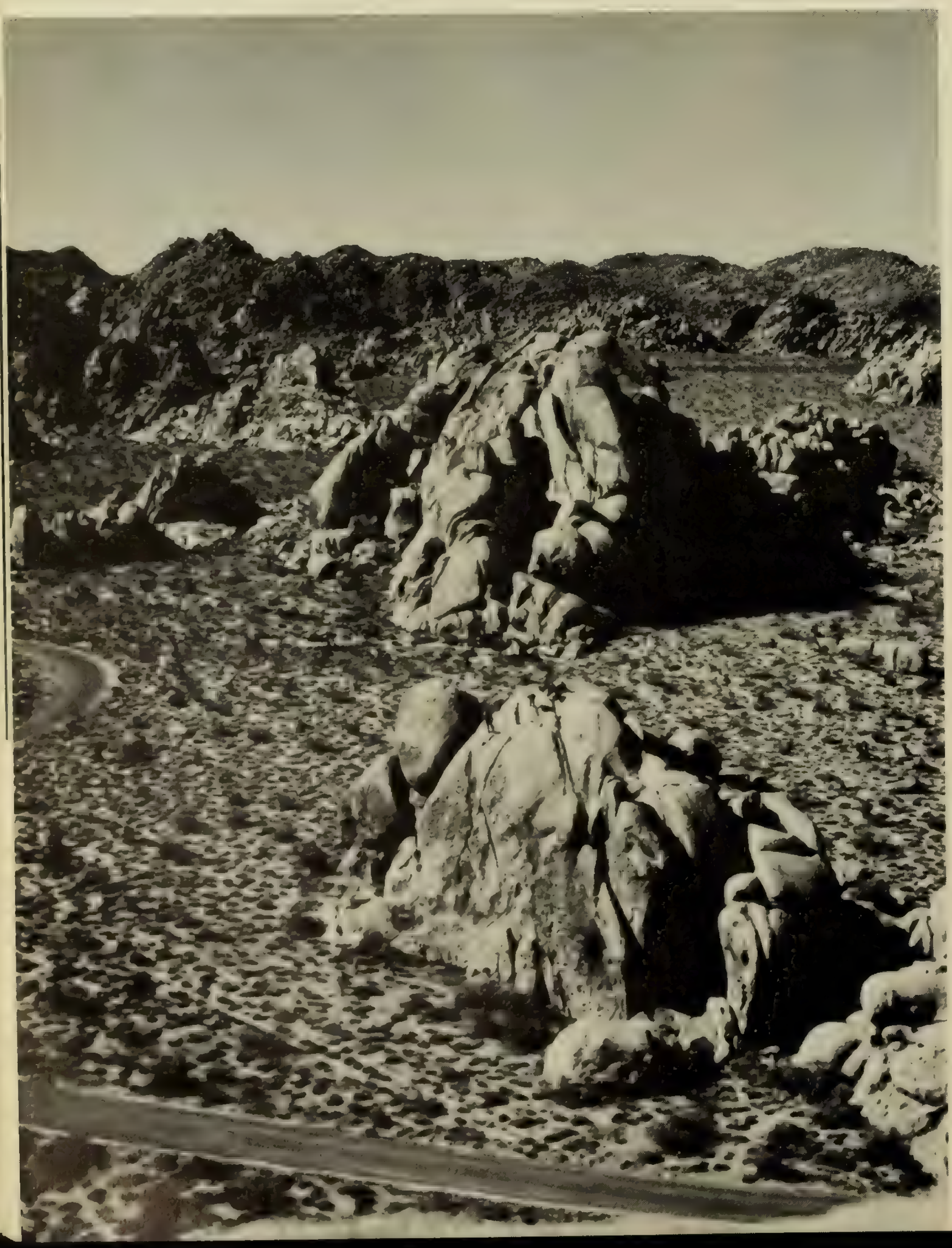
When several aircraft are flying cover, one pilot can go up high for effective transmission. Just be sure that someone is keeping the survivor in sight.

And when the helicopter appears, give it plenty of air room. Prop wash or disturbed air in the wake of a jet can be very troublesome indeed when the stump jumper is trying to concentrate on his rescue.

One of the most important aspects of getting rescued is making up your mind that a little time may elapse. Hence, the third of the four easy rules: *Prepare for a wait*. Regardless of how good the rescue chances may seem, settle down as if you have to be there for days. Help may be in plain sight, your friends may be orbiting and waggling all kinds of encouragement, you may see a helicopter winging its way toward you—but prepare for a wait, anyway. The situation can change in the twinkling of an eye. A sudden squall hides you from view. Your friends upstairs are forced to leave. The helicopter develops mechanical trouble and must turn back. Improbable? All these things have happened.

Where are you if you've dumped your survival kit and jettisoned your smoke flares? Up the creek and not a paddle in sight. This is what the specialists emphasize again and again; never count on a quick rescue. Never. Not when you're down at sea, not when you're down on land. The rescue detail will do everything in its power to bring you home as soon as possible. Count on that. But prepare for the wait, anyway.

This illustrates how difficult it is to spot survivors from the air. How many can you see?



Unless ground-fire or other enemy action dictates otherwise, it is better to stay in the vicinity of a crashed plane because that is what the rescuers are most likely to spot from the air. And keep a close eye on your physical condition. If you find it desirable to make tracks away from the airplane, your best bet is to make haste slowly, taking care not to wear yourself out in frantic flight over rough terrain. If for any reason you have to walk to a more accessible area, take it easy. A mile a day made by a fellow who takes reasonable precautions is better than 20 miles made by the man who moves so fast that he exhausts his strength too soon. In general, the best formula for moving through the wilds is to bring along as much survival gear as you can carry comfortably.

Of course you will want to *cooperate* with those people who are risking their necks to save yours. If cooperation were merely a matter of good intentions, it would be pointless to mention it at all. The fact is, cooperation with the rescue people is based on knowledge. You must know enough of the procedures they follow to be able to lend them a hand. As far as a helicopter is concerned, this is mostly a matter of knowing the capabilities and limitations of the machine itself.

One of the best ways to get the word is through talking with the chopper drivers themselves. You'll find these earnest, hard-working men just as interested in doing their jobs as any of the "fixed wing" crowd. The difference is that usually several lives are at stake whenever one of the whirlies sets out on an errand.

If you're stationed near a 'copter outfit, go and visit them. The lads will tell you that they make their rescues in three ways, depending on the circumstances:

- Hovering — The survivor gets into the sling and is hoisted into the hovering helicopter. This is the usual method. When needed, a crewmember may be lowered to help out.
- Running — The survivor grabs the sling hanging below the 'copter as it flies by. This method has its risks, but may be necessary at times.
- Landing — Quite often the choppers are not equipped with a hoist or the density altitude is such that a hovering pickup is impossible. In

that case, it is up to the survivor to make a clearing or move to a suitable landing spot for the 'copter.

As a survivor you must decide where to be and what to do on the basis of the above methods.

There are a few small gimmicks that you should know about in water rescues. Upon reaching your position, the chopper pilot will make a steep, near vertical approach to the raft and will hover directly over you. The downwash from the rotors will encircle the raft and hold it under the helicopter. The sling will be lowered to hoist you aboard. Consequently, only as a last resort should you abandon the protection of your raft. Just throw out the sea anchor and hold your position.

Get rid of your parachute if you've been using it for shelter. It can blow from the downwash created by the main rotor. The chute may billow and foul the tail rotor of the helicopter. When that happens maybe nobody gets rescued.

So there are the musts for cooperation at sea. Make yourself as stationary a target as possible. See that your opened chute is out of the way and will not foul the 'copter rotors.

Now, how do you get in the sling? There's only one approved method. Place the sling over your head, behind your back and under your armpits. Keep your elbows close to the body and hold on. Your own weight holds you in the sling. If there is a chest strap, fasten that, too.

If the sling seems too small, the chances are there's too much air in your Mae West. Deflate Mae until you fit. Note also that during the winter months the added bulk of heavy flight gear may force you to squirm a little to get into the sling, but you can do it.

Sea rescues are not too complicated. It's on land that your finest cooperative efforts are called for.

In spite of the cheery articles in the slick magazines, helicopters do have limitations. They can't hover over a gnat's back on a mountain peak or beat their way down a mine shaft looking for you. Not that most whirly-bird pilots wouldn't try to do those things if a life were at stake, but the chances of success would be dim. When you know what the machine can do the mission is more likely to succeed.

To get you over the land, a good pilot always bears in mind several special factors in addition to his normal problem of flying with head, hands and feet. They are:

- Wind direction and velocity.
- Contour of the terrain and the number and kinds of obstructions in the area.
- Altitude of the survivor (you).

Whatever help you can give him in determining or overcoming any of these makes his job simpler.

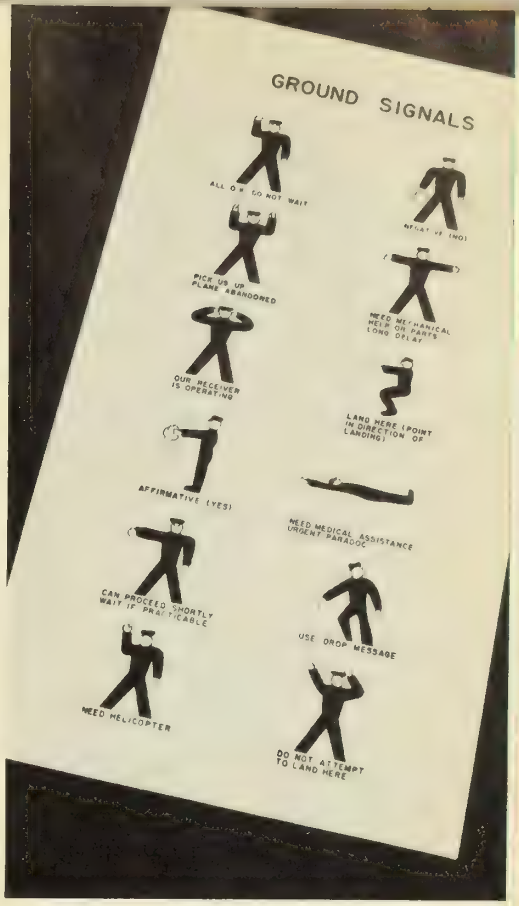
Indicate wind direction for the pilot by lighting your smoke flare when you see the 'copter approaching. This has the added benefit of helping to spot you. Remember that with the helicopter's limited fuel supply, time is important. Work fast, but use your judgment, too. If you light the smoke flare when the helicopter is too far off it may dissipate too soon.

Without a smoke flare, you must improvise. Throw dirt, dried leaves or anything else into the air and continue to do so until the whirlybird pilot spots you. If the wind is strong enough, hold up your scarf or some other piece of cloth. When the ground is frozen and you have no other means of making like a human wind sock, turn your back to whatever wind there is and swing your arms vertically along the sides of your body to indicate the wind line. The idea is to help the pilot as much as you can.

Most people think of helicopter rescues only in the terms of "hover and hoist." But a man in need must also consider where the 'copter can hover and how far it can hoist. Normally helicopter pilots prefer to hover in ground effect which is about the radius of the rotor disk.

The cable on the helicopter is only 75 feet long. If you are surrounded by trees, buildings, telephone poles or other objects, the cable may not reach you. With your added weight the pilot needs forward as well as upward motion to get going. Always make for an open area. Try to get clear of all obstructions. In mountainous country where a running pickup is usually necessary, find an open area and try to allow enough "up wind" clear space to avoid obstructions while being hoisted on the run. Don't be at the bottom of a ravine waiting for a 'copter to come. It can't.

At high altitudes, the helicopter cannot hover and hoist. It must have forward speed to stay aloft. The 'copter pilot knows this; he hopes you know it too. You must be poised in an open area like a sprinter, ready to grab as you go. Hanging on under these circumstances is not the easiest stunt in the world, but many people have done it. If you can hang on long enough to be hoisted or even for the pilot to descend to a safer place at a lower altitude, you've got it made.


GROUND SIGNALS
ALL OK DO NOT WAIT
NEGATIVE (NO)
PICK US UP PLANE ABANDONED
NEED MECHANICAL HELP OR PARTS LONG DELAY
OUR RECEIVER IS OPERATING
LAND HERE (POINT IN DIRECTION OF LANDING)
AFFIRMATIVE (YES)
NEED MEDICAL ASSISTANCE URGENT PARADOC
CAN PROCEED SHORTLY WAIT IF PRACTICABLE
USE DROP MESSAGE
NEED HELICOPTER
DO NOT ATTEMPT TO LAND HERE

Emergency signal cards should be a must with every unit and carried by all flight crews.

Many organizations have prepared emergency signal cards that pilots carry with them. This card graphically displays standard rescue signals used by the potential survivor to communicate with the circling airplane or chopper driver.

The main idea is to be prepared to aid the man who spots you, every way possible. So — read over the helpful books and pamphlets on survival. Be sure you know the proper way to tell the world about your troubles. Always be prepared to wait. Hang onto the emergency equipment you know you'll need. Talk with the helicopter pilots about their ways of operating. Be set to help the fellow who is helping you.

Rescue techniques and devices are being developed daily. But no matter how good they get, their effectiveness always will depend in part on your anticipation, communication, preparation and cooperation. ●

LOX

IT'S ONE OF THE many things that make high-altitude flight possible. The fighter pilot uses it from the ground up, and the bomber crews have it within easy reach at all times. It's the only antidote for those bluish fingernails and that slap-happy feeling that leads to oblivion at altitude. It's your friend and mine, OXYGEN.

By now every airman should be fully aware of the necessity of oxygen in connection with high-altitude flight. This then is not to expound further upon its use, but rather to introduce a new development in its packaging.

An excellent place to start would be with the first recorded flight into high altitude. Man's first representatives in this venture were three European scientists: Sivel, Croce-Spinelli and Tissandier. In the year 1875 they set forth and ascended to an altitude of 28,820 feet in a balloon. These men had anticipated the adverse effects of the rarified air at high altitude and carried with them several small balloons filled with oxygen. Because the supply was so small, the men hesitated to use the oxygen. They hesitated too long. The men were unconscious from lack of oxygen before the balloon reached 26,000 feet, and only Tissandier lived to relate his experience.

Since that time, efficient gaseous oxygen systems have been developed. Aircrews need no longer hesitate to take full advantage of their oxygen supply. With the advent of aerial refueling, the range of airplanes such as high-altitude bombers and fighters was extended almost indefinitely. The time limits of human endurance came to be more and more the factors governing flight duration at high altitude.

The answer to the problem of oxygen supply was to produce pure liquid oxygen by the fractional distillation of purified, liquid air and carry the liquid oxygen in containers which could also serve as units to convert the liquid into the gaseous form again.

A 25-liter liquid oxygen converter occupies only one-eighth of the space required for a gaseous type oxygen system of the same capacity. The liquid converter when filled weighs approximately 132 pounds, while the weight of a comparable gaseous system is approximately 459 pounds.

In addition to conserving space and weight, the 25-liter converter permits easier installation. For example, each converter requires only seven connections on the manifold panel, as contrasted with more than 100 connections for a comparable gaseous system.

The oxygen-production qualities of the converters have almost tripled the comparable capacity of the gaseous system on the B-47. The early series have a conventional low-pressure oxygen system which provides either 143 or 198 cubic feet of oxygen for the crewmembers. This is sufficient for approximately 15 hours of normal high-altitude operation. B-47s coming from production now are equipped with a liquid oxygen system which will supply 392 cubic feet, and the aircraft will have provisions for the installation of additional facilities which will boost this total of 588 cubic feet.

Now let's look into some of the peculiar properties of liquid oxygen. First, high-purity liquid oxygen is a bright blue, transparent liquid which flows like water. At normal atmospheric pressure the liquid is at a temperature of minus 297.4°F. Because of the extremely low temperature of the liquid, the physical properties of materials it comes in contact with can be altered greatly. Rubber hoses used to transfer liquid oxygen must be handled with care because the hoses freeze and become brittle. Carelessness in handling liquid oxygen will result in severe skin burns and damage to valuable equipment.

Oxygen in the concentrated liquid form has a greatly increased potential capacity for supporting combustion. If the vapor from liquid oxygen mixes with gaseous fuel and is ignited, a violent explosion may occur. Normal precautions, such as those required on the gaseous type oxygen systems, will eliminate the possibility of combustion or any other undue occurrence.

As far as flight crewmembers are concerned, the operation of the liquid system will be the same as the operation of the gaseous system. But like any other component or system of your aircraft, it is always well to be completely familiar with a new adaptation and to assure that all crewmembers have a working knowledge of its functions.

The "ungarbled" word for all types of oxygen systems may be found in current Technical Orders. If you have not done so already, it would pay you well to read and heed. Oxygen, like altitude, can work for ya' or agin' ya'. It depends on you. ●

ARE YOU SITTING PRETTY ?

Just sitting around looking pretty is okay for this little gal. She undoubtedly isn't waiting for rescue following a bailout (No GI shoes). If she did fall into this category, she could do something better than just sit there. There are many ways to help your chances of rescue. Look at page 24 and see for yourself.

Mal Function

Dressed for summer, Mal flies high,
Temperatures here like Eskimo pie.

Canopy fails, and leaves Mal's craft,
Hero is faced with cold, cold draft.

He's finally down, but way too late
'Cause round-out arm is frozen straight.

★ U. S. GOVERNMENT PRINTING OFFICE . . . 311700

27.1305
FL43

JULY, 1955

FLYING SAFETY

UNITED STATES AIR FORCE

THE LIBRARY OF THE
[illegible]
UNIVERSITY OF ILLINOIS

From Oh to Zero...

PAGE 4

FLYING SAFETY

VOLUME ELEVEN NUMBER SEVEN

Department of the Air Force
The Inspector General USAF
Major General Howard G. Bunker
Deputy Inspector General

Brigadier General Joseph D. Caldara
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

STAFF

Editor
Major Joseph P. Tracy

Assistant Editor
Major Perry J. Dahl

Managing Editor
Captain John H. Moore

Art Editor
M/Sgt. Steven Hotch

Production
Major Ben H. Newby
T/Sgt. William H. Johnson
T/Sgt. Nicholas Shekitka, Jr.
T/Sgt. G. J. Deen
T/Sgt. Carl E. Fallman
S/Sgt. Al. Fortune

CONTENTS

Page

Crossfeed 2
From Oh to Zero 4
Big Wind Scurry 14
Helping Hand 16
Rex Says 20
That Magic Area 22
Well Done 25
Keep Current 26
Goof and Live! 28

Where are you? If you are not sure, see the article appearing in next month's FLYING SAFETY.

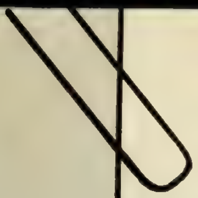
SUBSCRIPTIONS

FLYING SAFETY magazine is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished.

★ ★ ★

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in *Flying Safety Magazine*. Contributions are welcome as are comments and criticisms. Address all correspondence to the Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1



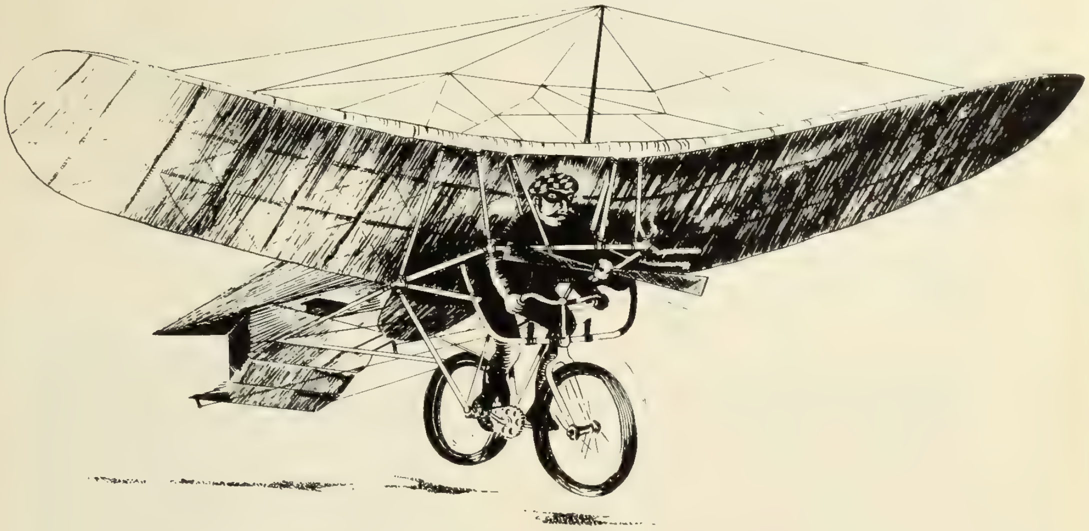
AT LAST!

AN AEROPLANE FOR EVERYBODY!

FLIES WITHOUT AN EXPENSIVE MOTOR

Think of flying with mere foot power. It pedals like an everyday, inexpensive bicycle. This is the only aeroplane that will do it. It is the smallest and most efficient of all aircraft. No longer is flying the sport of acrobats and millionaires. Every man and boy in the world can build one of these remarkable aeroplanes with ordinary tools in a few weeks and learn to fly at home with safety. No shop is needed. If you can use a hammer, saw and a pair of pliers, and have a shed, barn, a basement or a back yard you can build one of these remarkable fliers for a few dollars and in your spare time if necessary. Costs run less than 1/50 the cost of the average aeroplane and can be built for less than a fifth the cost of going to a flying school. It is the smallest, simplest, safest and most successful aeroplane in the world. The wonderful . . . . . .

BICYCLE-MONOPLANE



YOU CAN BUILD IT

Remember, this is not a toy or an experiment, but a thoroughly perfected man-carrying aeroplane with 18 foot spread and a speed of **several miles an hour.** Lifts 190-pound man with the greatest ease. Hundreds are already in use in the United States, Canada, Mexico, South America, England, Australia and the Philippine Islands. Hundreds of amateurs are building and flying these Bicycle-Monoplane aeroplanes, men and boys who knew absolutely nothing about aeroplanes and flying before. It is the simplest and safest flyer in the world.

WORKING DRAWINGS $2

Send $2 at once for a complete set of working drawings of this wonderful monoplane showing all details and dimensions in a simple manner so you can easily understand everything. Here is your chance to get into the greatest of all industries. Thousands of experienced flyers and builders are needed.

DON'T MISS THIS CHANCE! SEND $2 NOW!

BICYCLE-MONOPLANE INC.
Designed by an expert
6401 North Main Street, San Diego, Calif.

Yes, sir! Them was the days. Probably the fearless aeronaut didn't have to be an acrobat or millionaire to enjoy every mad moment of this contraption, but such a background might have been helpful. It's just a bit different today. The poor but honest aeronaut is flying a million-dollar machine and he's working for one of the biggest organizations in the world — The United States Air Force. His knowledge, training and responsibility represent a tremendous investment. And, unlike his predecessor, he cannot leap onto his bicycle-monoplane and pedal off into the blue, but rather lights the fuse and roars away at supersonic speeds. Efficiency of flight can only be achieved by constant study, assimilation and practice.

LETTERS TO THE EDITOR

Some of our readers want us to re-emphasize a point in the article titled "You-Safe Co-Op" that appeared in the April 1955 issue of FLYING SAFETY. You may remember that we were discussing the overall flying safety program that has been implemented within USAFE. At one point we stressed the value of standardized techniques and procedures and noted that the supervisory people over there have taken approved standards and lumped them together into usable packages.

Every pilot knows it sometimes takes a lot of digging to find all of the answers on any airplane. This is especially true of emergency procedures and the neat, packaged deals that USAFE produced are hard to beat for handiness.

Everything that they have lumped into the small, compact instructional books, is taken from applicable technical orders. They've eliminated the maze of "we-dare-you-to-find-it," so common to certain TO's and put basic know-how at the pilot's fingertips.

★ ★ ★

C-1 Survival Vest

Maybe I'm just hard to please, but after some first-hand experience with the C-1 survival vest during this last eastern fracas, I decided that it could be improved upon. I put in the usual gripes and got the usual action. Nothing. Repeat, nothing.

I don't go too much for this griping unless the gripe is accompanied by a better solution or at least a constructive suggestion, so-o-o I thought my next move had best be to come up with the same.

Working with the local parachute shop to take care of the necessary stitching, my recommended replacement for the C-1 is a small carrying bag which will hold everything that the C-1 holds, plus room for extra socks and muffler too. It measures 11 x 7 x 3 inches and through the attaching strap arrangement, it can be converted to a small knapsack for easy carrying in case you are in for a walk in your survival attempt.

Of course, it can be fitted with less than the full complement of survival equipment for stateside use. I don't believe that aircrews flying over the more populated areas in the Z. I. need as much survival gear as when flying over remote areas of the world. The kit has been submitted to AMC for their consideration.

Capt. Ken Wilkinson
Flight Test Branch
Griffiss AFB, New York

In our books Captain Wilkinson is entitled to his own pet aversions, especially if he includes a "fix." There isn't anything that can't be improved upon, so good luck to you, Ken.

★ ★ ★

Foggy Facts

After reading your article, "Foggy Facts", appearing in the May issue, I get the impression that special VFR operations in control zones are only authorized when aircraft are visible to the control tower operator or each aircraft is visible to the pilots of other aircraft concerned and the pilots can maintain their own separation.

These circumstances permit the controller to use reduced separation standards (IFR) when in his opinion adequate separation can be provided by this means. The procedures are not predicated on either the aircraft being visible to the tower or to the pilots involved. (Reference Par. 3.800, ANC Procedures for Control of Air Traffic.) These factors determine whether or not standard IFR separation will be used.

We in the air traffic control business appreciate your efforts to acquaint pilots with traffic control procedures. This media should prove beneficial to all concerned.

Maj. Noel E. Turner
Director of Flight Facilities
1801st AACS Gp. Hamilton AFB.

"Foggy Facts" cited an example whereby aircraft may depart or arrive at a base during below minimum weather conditions without standard IFR separation.

If the story didn't arouse your curiosity, maybe Major Turner's letter will. Check paragraphs 3.80 and 3.800 of the ANC Procedures for the control of Air Traffic.

★ ★ ★

Extra Omni Angles

With all due respect to the integrity of Major Mercer who wrote the article titled "Extra Omni Angles" in the May issue of FLYING SAFETY, there are a couple of points I believe need further explanation or correction. He never once mentioned whether or not the No. 2 needle was inoperative along with the RMI. The solution of the problems discussed in his article would greatly change, dependent on this factor. Also, this fact not being mentioned might create a little confusion.

The main points I'd like to discuss are as follows:

- The No. 2 needle always indicates the magnetic bearing *to* the station whether or not the RMI is working.
- The heading pointer is inoperative when the RMI is inoperative.

Due to the fact that the No. 2 needle works off the same signal as the vertical cross pointer needle (VCPN), it is very unlikely that the No. 2 needle would be inoperative while the VCPN is operating (although it is possible). During an orientation, the fact that the No. 2

needle always indicates the magnetic bearing to the station eliminates usage of excessive time because the pilot can turn immediately to the proper heading to the station. After rolling out on this inbound heading, or while he is in the turn, he can crank in the inbound bearing in the course selector window as read off the No. 2 needle. If the course selector window is inoperative, the course selector knob can be turned until the VCPN is centered. When the VCPN is centered, the aircraft is then inbound on the radial that is indicated by the No. 2 needle and course selector window. This procedure works the same with the RMI inoperative.

As far as the relationship between the RMI and heading pointer is concerned it just about boils down to the fact that if the RMI is inoperative the heading pointer is inoperative because they are geared together. The RMI can be inoperative in one of two ways. It either turns as the aircraft turns, even though it doesn't indicate the proper heading, or it becomes stuck on one particular heading indication and does not turn as the aircraft turns. If the RMI is stuck on one heading, the heading pointer is completely inoperative. If the RMI turns as the aircraft turns and does not indicate the proper heading, a pilot can figure the difference between the RMI heading and the aircraft heading and still use the heading pointer for orientations in most cases. The difference between headings would always have to be applied when reading the heading pointer which would make it a little difficult to figure drift corrections going into the station. For all practical purposes, though, the heading pointer also is inoperative in the latter case.

We, in the Instrument Section at Goodfellow, think that the No. 2 needle is the most important part of the omni equipment because it *always* tells you the magnetic bearing *to* the station no matter what your position is, and also is the least likely instrument to go out without all of the equipment being inoperative.

Capt. Fred W. Cronn
Goodfellow AFB, Tex.

Good stuff. Sounds like the good Captain knows what he is talking about. Thanks for the added info.

★ ★ ★

Gremlins

Your attention is invited to the attached photo showing operational "Gremlin" which is furnished for your information and retention.

This particular concept for the reporting of those "almost-but-not-quite" accidents was developed and placed in effect by this headquarters on 1 April 1955.

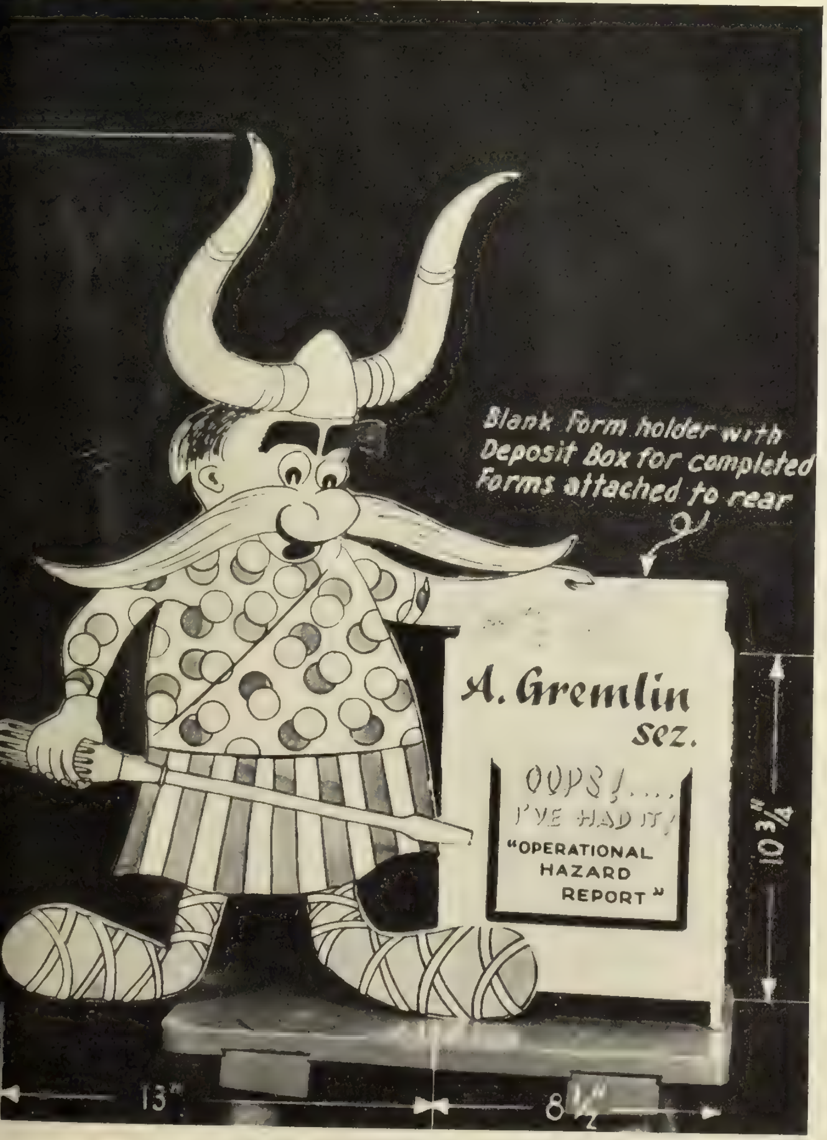
Our personnel have been indoctrinated on the use of the "Gremlin" form, and we are pleased with the results. To date over 20 reports have contributed immeasurably in reducing the potential aircraft accidents. With continuous emphasis and indoctrination, we are convinced that this sort of hazard reporting will prove to be an invaluable adjunct to our Aircraft Accident Prevention Program. As you probably surmised, we have adopted your suggestions regarding the "Operational Hazard Report" discussed at some length in your publication, "Aircraft Accident Prevention," Guide No. 2, dated 1 March 1955.

Photos with "Gremlin" format were furnished to Headquarters, Air Materiel Force, Europe, in sufficient copies for dissemination to safety officers throughout the command. If you so desire, a brief sketch of the "Gremlin" may be published in the Air Force *Flying Safety Magazine.*

Capt. David B. White
Asst Adj. 7485th Air Depot Wing
APO 207, New York

The old Gremlin is back in business again. One difference; this time he's on our side.

This operational hazard reporting system features A. Gremlin.


Blank Form holder with Deposit Box for completed Forms attached to rear
A. Gremlin sez.
OOPS!.... I'VE HAD IT!
"OPERATIONAL HAZARD REPORT"
10¾"
13"
8½"

from Oh to ZERO

An all weather Air Force. That's what we are striving for. And it's working out. Pilot proficiency is being stressed and requirements met. Cockpit instrumentation and lighting are coming along in good shape, and navigational aids are of sufficient caliber and reliability whereby Air Force types can take off and land without ever seeing the ground.

Just when things start to look rosy, up pops another problem. Like all plans of mice and men, things sometimes go awry. In one case the dilemma was "How can an all weather fighter interceptor pilot perform all the functions required of him and complete his mission?" True, if he had enough eyes, ears, arms and legs he could watch the gages, check the letdown charts, acknowledge transmission, perform the various tactical operations required and fly the aircraft. But most jockeys are handicapped by possessing only two each of the above mentioned anatomical items.

So what happens? Does the Air Force decide to discontinue all weather operations? Negative! It has reached deep into the bag and come up with some real fine techniques and procedures designed to help the pilots.

What we discuss here is use of the ILAS, utilizing Zero Reader or Omni equipment, whichever is installed. Now don't you advocates of the GCI letdown with a GCA handoff go walking away shaking your heads. It could well be that knowing about the Instrument Low Approach System could someday get you out of a rather hairy situation. The first part of this article covers Zero Reader-equipped aircraft; the second covers those equipped with Omni, an automatic pilot and the automatic coupler.

Before people got a little shook and brought it all to a screaming halt, the boys down at Tyndall AFB were shooting touch-and-goes with this equipment when you couldn't see the length of a .50 caliber slug. They did it as a matter of course and never came close to losing an aircraft during the process.

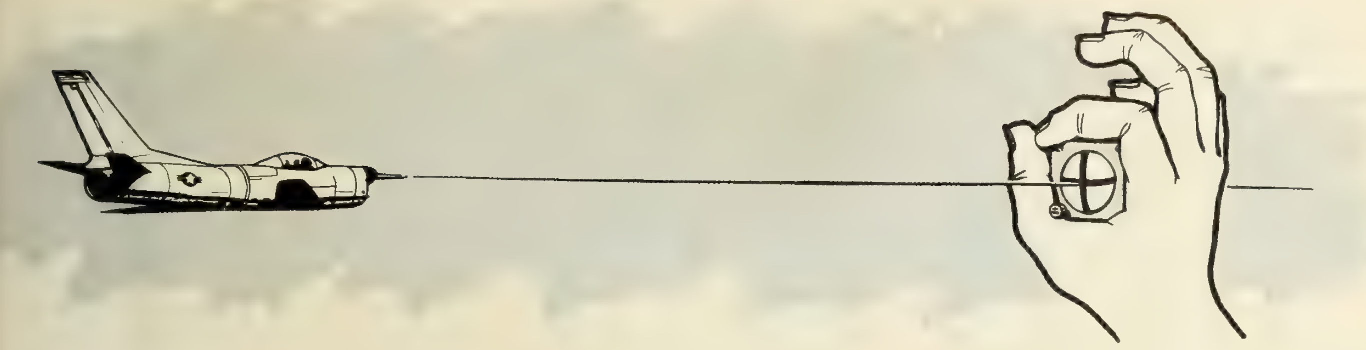
the Zero Reader

IN THIS ARTICLE we are going to delve into the inner workings of the USAF Flight Director, more commonly known as the Zero Reader, manufactured by the Sperry Gyroscope Co. Now before you fly types flip your lid, eject through the canopy and groan something to the effect that you don't even want to hear about another instrument in the cockpit, best you regroup and see what it says in the fine print at the end of the contract. Could be that after you read what it is, what it can do and how to use it, you might even get enthusiastic about it. Most people who are familiar with it, like it — in spades.

Okay, you say, so it's different, but I still have to add it to my cross-check in the cockpit. True. But that's okay if it eliminates several other instruments, isn't it? And that is this little dude's big gimmick. It simplifies, makes things easier, helps the pilot without adding to his workload.

Specifically, the Flight Director (hereinafter referred to as the Zero Reader) is a gyroscopic flight instrument. It takes a variety of information from such sources as the gyro horizon, directional gyro, magnetic compass, sensitive altimeter and the ILAS and VOR indicators and presents it to a pilot on a simple two-element indicator. The instrument gathers this combined information, precomputes it and tells a pilot when, in what direction and how much to move the controls of his aircraft.

As stated before, at first sight the whole deal may seem like just another instrument in the cockpit. But a few minutes perusal makes it obvious that it introduces a new and basic instrument concept. The Zero Reader



anticipates or looks ahead of the existing facts; predicts the future consequences of present attitude and heading of the aircraft at a given moment.

All pilots are familiar with and have used those instruments which are generally considered primary; the gyro horizon, directional gyro, sensitive altimeter, magnetic compass and the ILAS deviation indicator. They might be termed attitude and displacement or "how goes it" instruments. They visually indicate degree of bank, present heading, altitude above sea level or how far you are from the center of a radio beam. This is information concerning your present condition, at a given moment.

The Zero Reader is a single instrument which, using two indicator bars or needles moving at right angles to each other, converts this "how goes it" information into control commands that a pilot follows. It merely states, "Go up, go down, go to the left or go to the right" as the case may be; and needs only one instrument to transmit these commands to a pilot. (That doesn't mean that a pilot never refers to his "how goes it" instruments, but he only has to monitor them occasionally.) Considerable mental computing, necessary under manual flight, is now done by the Zero Reader through an automatic computer instead of by a pilot. He flies it by keeping the two indicator needles centered, which makes for an easy-to-follow visual reference. And remember, the Zero Reader is much more sensitive and precise than basic flight instruments.

In other words, in this single-instrument indication, the attitude and displacement "now answers", individually shown by the basic instruments, are combined algebraically into a single prediction demand as seen by the relationship of the two indicator needles. Heading and roll signals are combined on the vertical needle, and a radio beam coupling can be added to the computation by switching them in at the pilot's discretion. Pitch attitude, altitude or glide path and go-around signals are combined on the horizontal needle. You are flying correctly when the two needles are zeroed in, hence the term, Zero Reader.

The Zero Reader is made up of two parts: The combined indicator and the selector switch. The combined indicator, as its name implies, combines two instruments, the flight director indicator and a heading selector, within a single housing. It has several functions: a. Provides on a two-element indicator a visual reference to the flight control movement required to do any maneuver. b. Permits a desired heading to be set into the flight director. c. Repeats the magnetic heading indication of the aircraft's compass system.

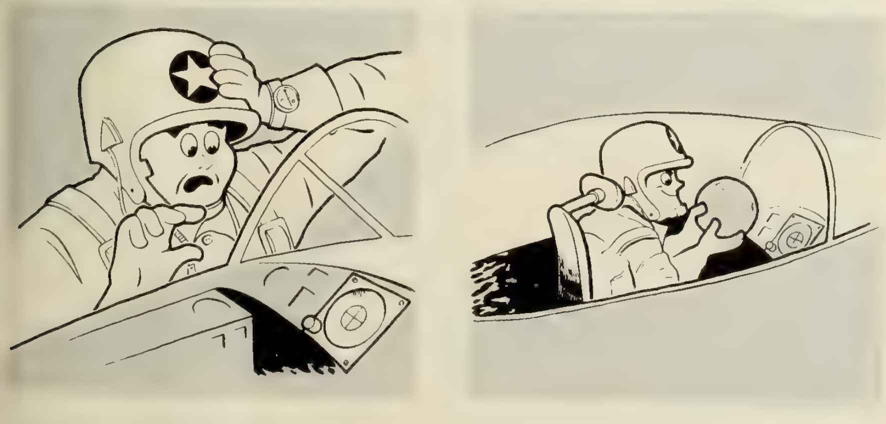
A selector switch enables a pilot to select the particular flight pattern desired or required at any time. Selection is made by rotating the control knob to any of four positions: FLIGHT INST, VOR-LOC BLUE RIGHT, VOR-LOC BLUE LEFT, APPROACH. Altitude control can be set in by switching another knob and a go-around is triggered by pushing in the altitude control knob.

- FLIGHT INST—The Zero Reader becomes a gyro-controlled flight instrument independent of radio signals in this position. Altitude control may be on or off.
- VOR-LOC BLUE RIGHT—Functions the same as above, plus the addition of a radio navigation signal. Signal source can be an ILAS beam, provided blue sector of the beam is on the right of the flight path. VOR is always used on BLUE RIGHT because it provides to-from indications without relating them to blue right or blue left indications.
- VOR-LOC BLUE LEFT—Is a reversal of the direction sensing of the radio signals for VOR-LOC BLUE RIGHT. In this case the blue sector is to the left of the flight path, as for VAR and ILAS.
- APPROACH — Same as VOR-LOC BLUE RIGHT plus glide path signal on horizontal needle.

Turns to Headings

Check Figure 1 to see just how simple this can be. Assume that a plane is on a heading of 200 degrees and the pilot wishes to turn to a heading of 290 degrees. The pilot sets

What, another instrument! Maybe, but this one is just like a crystal ball.



in the new heading and banks the aircraft toward the vertical needle sufficiently to center it. If he rolls in too little or too much, the vertical needle remains off center but the moment the aircraft assumes the attitude (bank) which will lead it to the desired heading, the needle becomes centered, or zeroed if you prefer. The system is as simple as that. As the 290-degree heading is approached, the amount of bank required to cancel the heading signal is decreased. This is indicated by a displacement from center by the vertical needle; taking off bank to correct this displacement recenters the needle. After reaching the new heading of 290 degrees, keep the needle centered to maintain the heading.

All during this simplified version of how one phase of the equipment works, the instrument is electronically doing all of the mental computing and looking ahead for the pilot. For example, it is continuously measuring the angular displacement of the aircraft from the desired heading, and as the angle decreases, it automatically indicates to the pilot, when, in what direction and how much to adjust the controls to reflect this continuous change in displacement.

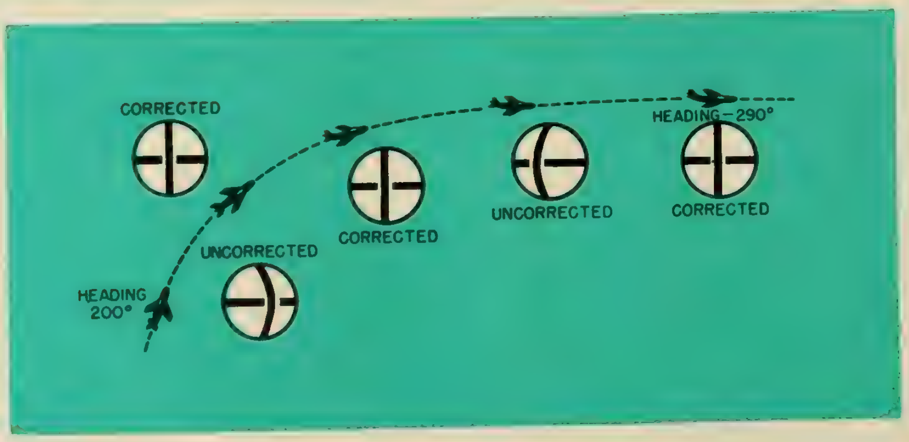
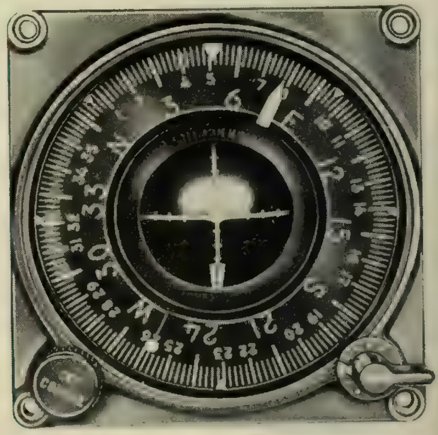


Figure 1. Keep the needles zeroed to stay on the flight path.



Combined Indicator of Zero Reader.

Actually, this is a good example of how the Zero Reader can be used to intercept the known heading of a radio beam. The interception is made evenly, without overshooting or bracketing.

Before getting into the many uses to which the Zero Reader can be put, let's restate one thing. The Zero Reader is not a primary instrument in the sense that an altimeter is, for example. The altimeter is the primary instrument for maintaining pitch attitude; the Zero Reader may not give exact information concerning the exact attitude or condition of the aircraft; for this it is necessary to cross-check the full instrument panel.

But in another sense the Zero Reader does become a primary instrument. It does tell a pilot that he is flying his aircraft in exactly the proper attitude to accomplish a desired maneuver, and frequently this is the only information he is looking for under certain conditions. This information becomes primary when he is faced with the task of achieving and accurately maintaining a new flight condition.

Okay, now let's take a look at some other uses of the Zero Reader. We have seen already how it can be used as a flight instrument to turn to and maintain a heading. We saw that the key to that was to get the needles centered and keep them there. Now let's take a look at what it will do for you on an instrument takeoff.

ITO, Climb and Level-Off

Set the pitch attitude control knob for takeoff attitude (you should experiment to find just where this belongs on your aircraft by trying it several times in good weather.) Get the aircraft aligned with the runway and be sure that the vertical needle is centered and that the horizontal needle indicates a "fly-up" deflection. (Be sure that the altitude control is OFF by checking to see that the green light on the selector switch is on.) At takeoff speed, pull the nose up to center the horizontal needle of the indicator. This needle, at this time, is purely a pitch attitude indication of magnified reference. Keep the needles centered until ready to turn to a preselected climb heading that conforms to your takeoff instructions and to your best climb airspeed. After getting on heading and reaching climb speed, adjust the pitch attitude trim knob to center the horizontal needle, which serves as a sensitive pitch indicator.

At the desired altitude, level off and turn the altitude control knob on the selector switch to ON. This automatically establishes this altitude as a reference. Keep the horizontal needle zeroed and you will maintain altitude; a gain or loss in altitude will displace the needle and call for corrective control movement. After reaching the desired altitude be sure and reset the pitch attitude knob to level flight. This control is especially useful in controlling altitude during turns and will be satisfactory up to 60 degrees of bank.

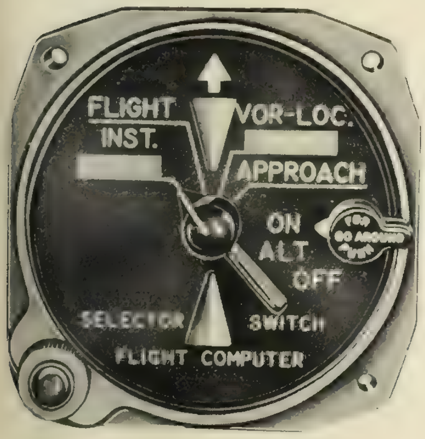
Turning the altitude control to ON, automatically makes any pitch attitude trim setting inoperative but, presetting a contemplated attitude change into the system enables a pilot to climb or descend immediately if the altitude control is turned off.

High Speed Turns

If heading changes are small, that is less than 20 degrees, the bank limits of 45 degrees built into the Zero

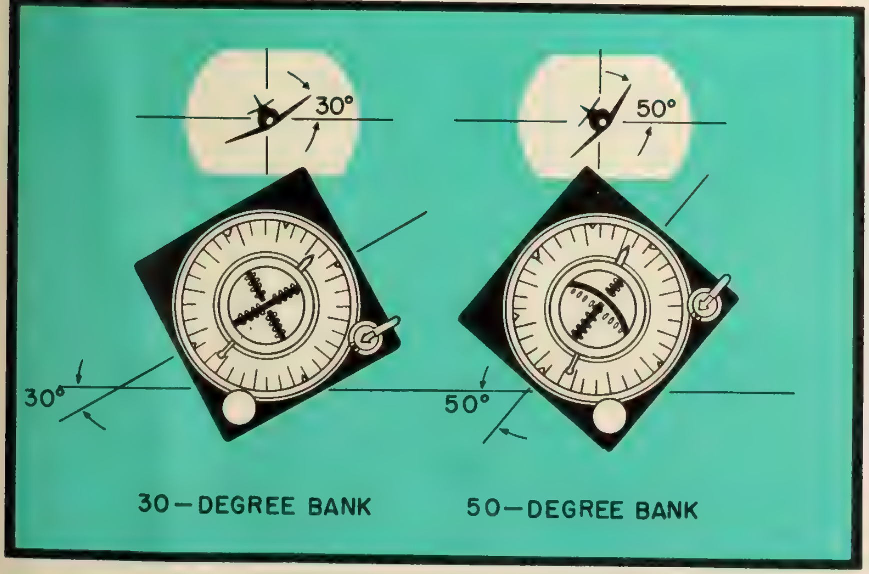
Reader will establish a reasonable rate of turn. However, if large changes in heading are desired this rate of turn may be too slow. To decrease the time of turn necessitates an increase in the angle of bank. This is done by overriding the Zero Reader and carrying the vertical needle deflection on the opposite side to the direction of turn.

For example, with the heading selector set well off of the aircraft's heading (more than 30 degrees), the angle of bank can be increased to 65 degrees by deflecting the vertical needle slightly over the one-half scale opposite the direction of turn. (See Figure 2). Center the vertical needle when approaching about 20 degrees from the selected heading. Holding it centered will cause the aircraft to roll out on the selected heading. In a steep turn with the altitude control on, remember to center the horizontal needle slowly whenever the indicator shows a "fly up" condition to avoid any possibility of a high speed stall. Turn error is eliminated with this instrument, and if a pilot follows the visual indications he will roll out with his wings level.



The four-position Selector Switch.

Figure 2. Opposite needle deflection indicates steeper banks.



Descent and Level-Off

For descent and level-off at a lower altitude, the Zero Reader is used in the same way as to climb out to a desired altitude. The horizontal needle is used to hold the pitch required to maintain the desired letdown speed.

A pilot can use the instrument in two ways. He can leave the pitch attitude control in the zero pitch mark and hold the needle in a deflected position to maintain his rate of descent. Or he can set in the desired letdown attitude on the pitch attitude trim mark and keep the horizontal needle centered. (For an extremely high rate of descent it may be necessary to hold a slight "fly up" deflection on the horizontal needle.) If the first method is used, level-off can be accomplished by centering the needle and, if desired, turning the altitude control to ON as soon as the vertical speed is on zero.

Uses in Radio Navigation

When using the Zero Reader to fly VOR and VAR range beams some functions, such as the altitude control and the manual pitch attitude trim, are used in the same way as when on FLIGHT INST position. This means that using the Zero Reader for radio navigation is an extension of its use as a flight instrument.

To intercept a VOR or VAR beam, tune the navigational receiver to the desired channel and check the ILAS deviation indicator for proper operation. (The ILAS deviation indicator is not part of the Zero Reader but is the regular cockpit instrument used in flying VOR-ILAS.) Then turn the selector switch to FLIGHT INST and the altitude knob to ON. Next, set-in an intercept heading on the heading selector which will provide a beam intercept angle of 90 degrees or less. Bank the aircraft to zero the vertical needle and the Zero Reader will take you into the beam on the set-in intercept heading.

Upon entering the beam, the vertical needle of the ILAS deviation indicator will begin to move toward center. Check the appropriate charts for the correct heading to the facility; set it on the selector. Immediately set the selector switch to either VOR-LOC BLUE RIGHT or to VOR-LOC BLUE LEFT, as required. (This will depend on whether the blue sector is to the left or right on VAR or ILAS.)

Fly the aircraft to zero the needles and you will arrive close to the beam center, contingent, however, on any crosswind being present. (Crosswind procedures will be covered later.)

VOR Approaches

In general, when using the Zero Reader for approaches, the techniques described for radio navigation are applicable. After intercepting the beam, center the needles and follow the beam on-course signal. As an example, assume the inbound heading to be 270 degrees, so that after passing the station on an outbound heading of 90 degrees, a procedure turn and letdown are necessary. (On VOR, use VOR-LOC BLUE RIGHT.)

Before initiating procedure turn switch to FLIGHT INST position and set in first increment of heading change (45 degrees). Zero the vertical needle and you will maintain this heading until ready to turn back to the intercept heading. After flying away from the beam the desired length of time, set-in the reciprocal heading (225 degrees) and fly to rezero the needle. As the beam is ap-

The Zero Reader also can be utilized as a radio navigation instrument.

proached, set-in the inbound heading, switch to BLUE RIGHT, zero the needle again and you will be on the correct heading.

During the procedure turn, an approximate rate of descent can be set into the Zero Reader while flying a constant altitude signal. After setting the pitch attitude trim knob to the estimated position, the descent is initiated by turning the altitude control knob to the OFF position. Reference to the rate of climb indicator may dictate a slight reset of the trim knob after the descent has started.

To eliminate the erratic indications that appear when passing over the radio station it is necessary to turn the selector switch temporarily to FLIGHT INST and follow the existing set-in heading. (Accomplish this approximately one minute from the station.)

For ADF and low frequency range approaches, the selector switch is left on the FLIGHT INST position. Headings are selected as required to bracket the beam and fly radio bearings. Control of elevation and rate of descent is accomplished using the altitude control and with the horizontal needle used as an indicator.

Zero Reader and GCA

Using any of the above approaches in connection with GCA is simplicity itself. After the letdown, the GCA controller will establish the aircraft on the downwind leg. At this time set in the heading given by the controller and establish the desired airspeed, keeping the needles centered.

Set-in the base leg heading when given by the GCA controller and put the aircraft into final approach configuration. Changes in heading on the final approach are set-in immediately when called off by the controller. Two-degree heading changes on the final may seem insignificant, but flying the Zero Reader and making coordinated turns will make for better results than using standard instruments which often require skidding and slipping to maintain heading.

Descent on the final approach is made using the horizontal needle of the Zero Reader as an attitude instrument in the same way that an artificial horizon is used. A pilot can select a fixed pitch reference (horizontal needle deflected) similar to that of the artificial horizon, or he can adjust the pitch attitude trim so that the horizontal needle will be centered on final approach. However, the recommended method is to use the horizontal needle as a sensitive pitch indicator by leaving the pitch attitude trim on zero and holding the needle off center.

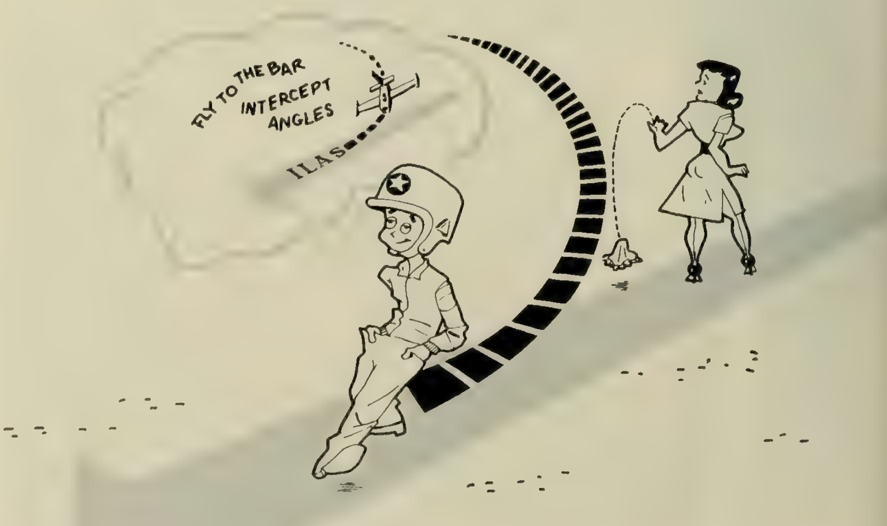
ILAS Approaches

One of the most important functions of the Zero Reader is its use in making ILAS approaches. As shown in Figure 3, assume that your aircraft is at position 1; altitude is 20,000 feet. You are homing on the middle marker using ADF and cleared for an approach. Set the heading selector on 315 degrees, switch to FLIGHT INST and keep the altitude control ON.

Two procedures are possible where an aircraft arrives over the middle marker before bracketing the localizer. (Obviously, if the beam is bracketed inbound and and then the procedure turn initiated outbound, the same general letdown procedure would be used.) The procedure in Figure 3 requires bracketing the outbound localizer immediately after obtaining the on-course indication over the middle marker. If flown at high speed without using the Zero Reader, several overshoots will occur before the aircraft is settled on course because of the narrowness of the beam at this location. Using the Zero Reader, a single overshoot will occur and the aircraft will settle on-course approximately 18 miles from the transmitter.

After zeroing the needles and flying the beam outbound with altitude control in OFF position, the selector switch in VOR-LOC BLUE LEFT and the heading selector on 270 degrees you are ready to start your procedure turn. At this point you can reduce power, extend speed brakes and start the descent. (We are assuming in this example that you are flying a jet. However, in general, procedures hold true for any aircraft.)

Center the needles to intercept and stay on the ILAS localizer beam.



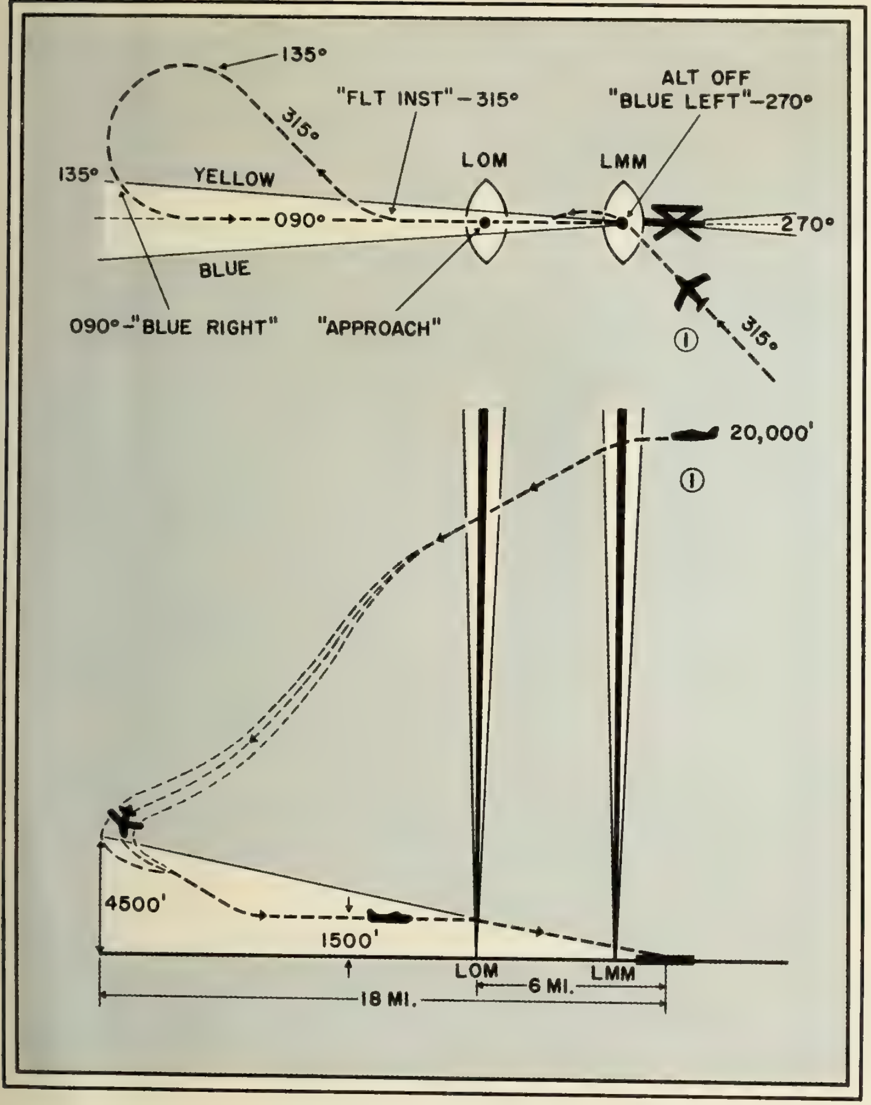


Figure 3. Two selector positions, FLT INST and APPROACH, are utilized in performing a jet penetration and an instrument low approach.

Various methods of procedure turns can be used:

- It can be made during descent.
- The descent can be stopped at an arbitrary figure, the turn completed and the descent continued.
- The descent can be continued to a low altitude and the turn initiated at this point.

Let's assume in this case, that the procedure turn is started immediately after settling on the outbound heading and during the letdown. Upon completing the turn, the heading is held until the ILAS deviation indicator shows that the aircraft is entering the localizer beam. At this point, set the heading selector to the runway heading of 90 degrees, switch to BLUE RIGHT and center the needle.

A shorter procedure is to continue on a course of 315 degrees for about one to two minutes after arriving over the marker, starting a left turn to 135 degrees on the Zero Reader and then bracketing the localizer inbound. In either case, airspeed requirements at high speeds require that a pilot responds immediately to the movement of the Zero Reader throughout the initial approach. Delays will result in high intercept angles and overshoots which will take the aircraft past the outer marker before the inbound localizer is bracketed. (This is applicable to jets only.)

At a distance of 18 miles from the runway, the glide path will generally be approximately 4500 feet above runway elevation. Most approach diagrams call for flying under the glide path and leveling out before entering it but, if you wish, you can save time by planning your descent so that the aircraft arrives at the glide path altitude during the procedure turn onto the localizer beam.

As you reach glide path altitude during the descent, the horizontal needle of the ILAS deviation indicator will begin to rise from the bottom of that instrument. As it starts, reduce the rate of descent and switch the selector to APPROACH. Your Zero Reader is now coupled to both the localizer and the glide path. All that is required is to keep the needles centered to remain on the center line and on the glide path. Reduce airspeed to that needed for lowering the gear and flaps before reaching the outer marker. As you pass over the outer marker extend gear and flaps and reduce power to establish final approach airspeed.

Drift Correction

The presence of a crosswind is automatically shown on the Zero Reader by a steady indication of drift angle on the heading selector. (The ILAS deviation indicator also will show a steady error with respect to a radio beam.) The drift angle is the angular difference between the compass heading and the set-in heading. The term steady is intended to apply to length of time; that is, a momentary or transitory indication would not be an indication of drift, whereas an indication of several minutes would signify drift angle.

In this case, align the aircraft heading pointer to the index marker (or align the two pointers). Fly the aircraft to zero the needles, this will correct for the wind and return the plane to the radio on-course signal indicated by the ILAS deviation indicator. It will remain there until the wind changes.

Don't keep fiddling with the knob when on final approach. You can make a correction after stabilizing on the localizer beam when nearing the outer marker and one more, if necessary, when at the middle marker. Another technique is to make your correction on the basis of reported ground winds and fly all the way down with that correction. If the Zero Reader installation includes an automatic crosswind compensator, such compensation will take place automatically on final when the selector switch is on APPROACH.

Go-Around Procedures

Last but far from least, the Zero Reader can be used for a go-around if you fouled up on the low approach. In the event of a go-around, depress the altitude knob on the selector switch (it's marked FOR GO-AROUND PUSH.) A yellow go-around flag appears immediately on the right side of the Zero Reader indicator. Now the indicator needles are no longer influenced by radio or altitude control signals.

Control your aircraft to zero the "fly-up" deflection which will appear on the horizontal needle. The resulting attitude has been selected to stop the descent quickly and to provide a pitch reference for the initial climb-out. Be sure to crosscheck the airspeed as the aircraft's configuration is changed and, if necessary, hold the horizontal needle off zero slightly to maintain the desired speed. After a safe altitude has been reached, disarm the go-around switch by turning the selector to FLIGHT INST. Adjust the pitch attitude trim knob so that when the indicator needles are zeroed the desired climbing speed is maintained.

If you don't desire to use the go-around feature, or if it is not installed, a missed approach can still be made using the FLIGHT INST position of the Zero Reader. Prior to reaching the outer marker when inbound on a final approach, set the pitch attitude trim knob to a predetermined climb reference. (Experiment with your Zero Reader to find a setting that will definitely stop your descent.) Then if you must make a go-around, you have only to switch to FLIGHT INST and control the aircraft to zero the horizontal needle. Check your airspeed and, if necessary, readjust the trim knob to maintain the desired indicated airspeed during the climb. It goes without saying that, using either method, it is incumbent upon the pilot to apply proper go-around power.

Naturally, there are many more details that could be gone into when discussing the Zero Reader. For example, when discussing how it should be flown in turbulence. The manufacturer recommends that it be flown loosely. That is, don't attempt to follow every small signal. Rather, attempt to average them out and select steady signals. We can't go into all the fine details in this article, so for detailed explanations of certain techniques best you take a good look at your instrument flying manual, ATRC 51-4. As a matter of fact, we'll bet a bob or two that you'll find a lot of things in the book that you might well brush up on. Why not give it a go, and see? ●

Omni for Fighters

IN CASE you haven't noticed, that piece of equipment commonly referred to as Omni is here to stay. True, there are many pilots who haven't had the opportunity to fly it, but it won't be long now. Stations are springing up like the weeds in your front lawn and more and more aircraft are being Omni equipped.

If Omni's only contribution was to provide a reliable means of getting from here to there regardless of the electrical disturbances induced by thunderstorms and other weather phenomena, it would be enough. But this amazing chunk of wires, tubes and fuses has proved its versatility almost beyond belief. Omni equipment, tied in with an Instrument Low Approach System, tied in with an auto-pilot, hooked up to an automatic coupler, strapped into an aircraft . . . (deep breath) . . . will bring you down to the runway by the "Look, no hands" method. But we're getting ahead of our story.

The versatility of Omni is particularly appreciated by the all-weather interceptor pilot. Normally speaking, the standard IFR approach for the jet driver is the GCI letdown with a GCA hand-off. It's a good system. It is reliable and has proved itself to be the easiest all-around method of getting out of the soup on to the gritty. But look at it this way. Any professional pilot is obligated to be familiar with the equipment provided him. The Air Force has provided alternate letdown methods involving a variety of equipment and you may sometime be called upon to put them into practice. When you arrive over an installation that has no GCI or GCA to assist you, but has an ILAS, you should know how to use it.

Perhaps the aircraft you fly is not Omni equipped, but it soon will be. In the very near future, all of you will have the necessary equipment to utilize the Instrument Low Approach System using the course indicator instrument of the Omni equipment. With this type of installation the Omni instruments are the only ones required to make a penetration and low approach, right down to the runway.

The AN/ARN-14 omnidirectional receiver is a VHF navigation receiver with associated indicators that provide reception of all Omni ranges, localizers and voice facilities on 108 to 135.9 megacycle channels. It has a control box and two instruments, the course indicator and the radio magnetic indicator (RMI). With this installation the pilot can home on any Omni facility using the standard Omni procedures. In addition, the glidepath and on-course of any ILAS can be tuned in and indications will be received on the course indicator. In a nutshell, you tune in an Omni station and make your letdown; then after turning inbound to the field, you switch a single selector knob to the ILAS frequency and fly the course indicator, using the vertical needle for directional control and the horizontal needle for the glidepath. It's just as simple as that.

Let's take a hypothetical case and follow an F-86D pilot through his entire letdown process.

Our hero is tooling along at 35,000 feet with an F-86D strapped securely in place. He notes that his destination has an Omni facility and has an ILAS installation First he tunes in the correct frequency on the Omni range. The control is located on the right console and is labeled VHF-NAV. After identifying the station, he checks the closest magnetic bearing inbound, as indicated under the double barred pointer on the RMI. He turns toward the pointer until it is at the top of the instrument. He rotates the selector knob until the desired bearing appears in the bearing window of the course indicator and he flies the vertical needle to the station. It's as easy as shooting fish in a barrel. Following station passage, he is ready to execute the letdown into the ILAS pattern.

ILAS Approaches

An ILAS approach requires considerable planning prior to execution and that's where the Pilot's Handbook—ILS Chart comes in. It shows the physical set-up and cross-section of the localizer and glidepath beams, location of the markers and altitudes to be flown. The transition point from the last radio navigational aid to the ILAS procedure is shown in detail. Normally the localizer beam is tuned in and intercepted after passing the Omni range station. However, if utilizing an ADF or low frequency range for penetration purposes, as discussed later, the ILAS frequency can be tuned in before starting the letdown.

When the weather is on the deck, the Omni equipment is a real life saver to the all-weather interceptor pilot.

When cleared by the controlling agency for a penetration and low approach, our boy executes a standard penetration for that station and departs the range on a heading that intercepts the localizer beam of the ILAS. By this time he has turned the frequency selector on the VHF NAV control panel from the Omni station frequency to the published ILAS localizer frequency. Now the location of the on-course line is represented by the vertical needle of the course indicator and the glidepath is reflected in the horizontal needle. He takes care to note that there is no alarm flag indications on the course indicator instrument indicating some malfunction.

There are several combinations that he could use to make an initial penetration and get down into the ILAS pattern. He could make an ADF letdown using a homer or the outer or middle marker of the ILAS. In such cases he would have the ILAS frequency already tuned in, and warmed up. He would use the ADF feature of the radio compass for his letdown and, upon leaving the homer, merely bring the course indicator into his crosscheck to intercept the ILAS localizer beam.

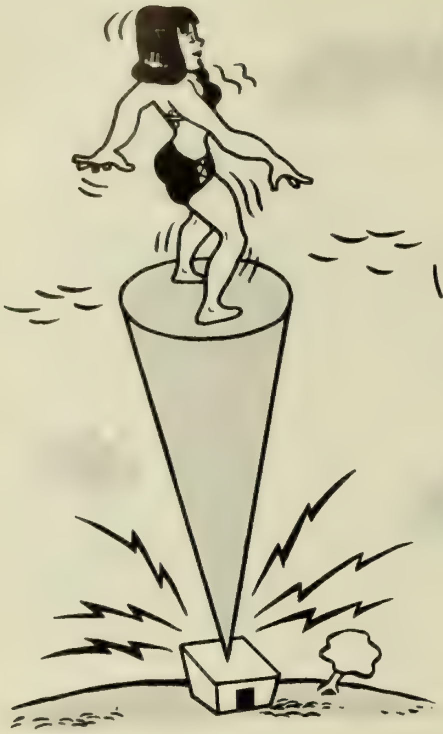
Regardless of whether he executes the penetration using an Omni station, a homer or a low frequency range, the procedure is to leave that facility on a heading that will intercept the ILAS localizer (center line) and have the ILAS frequency tuned in, identified and ready to operate.

Beam Following

Upon intercepting the on-course our F-86D pilot maintains a constant inbound heading with the vertical needle centered. Movement off the beam is caused by wind (assuming the magnetic heading is maintained accurately). The rate of deflection is, of course, indicative of the wind direction and velocity. It's a good idea to get and remember the surface wind velocity and direction as given by the control tower. That prepares you for a drift factor, to right or left, so you can better establish an on-track heading. It is important to crosscheck the needle rapidly and the first off-course indication should be immediately counteracted. Corrective turns must be coordinated, and degree of bank shouldn't exceed the number of degrees to be turned.

As he flies the localizer, his altitude is at the designated approach altitude and the airspeed is reduced to the final approach speed. He lowers the gear and completes the final flap adjustment. The correct altitude is maintained during the reduction in airspeed and is held until the glidepath is intercepted.

Precise beam following is of prime importance during the entire run. The approach altitude is normally 1000 feet above the field elevation, and at this altitude the glidepath is intercepted over the outer marker. As



Disconnect the coupler before passing the station. The plane will follow the needle.

soon as the horizontal bar of the course indicator starts to move down he prepares to make the power reduction to establish the correct descent. When the glidepath crosspointer (horizontal needle) arrives at the center line of the instrument, he reduces power to the correct setting and establishes a descent at the desired rate.

Any corrections required to get back on either the glide path or the center line should be crosschecked using the attitude gyro. Likewise, the airspeed indicator should be closely observed. Normally the power is kept constant during final approach, however, if the airspeed exceeds plus or minus 5 mph from the desired, a change in power is made.

As the aircraft flies inbound, the altimeter should be crosschecked over the middle marker to determine the accuracy of the glidepath beam. The correct altitude is listed in the Pilot's Handbook—ILS Chart. In the event you are on the glidepath but the altimeter indicates that you are 50 feet or more from the published middle marker altitude, go-around. It is obvious that if the beam or the instrument causes this much of an error, continuing a low IFR approach would be hazardous.

A little gimmick that many drivers use is to have the GCA controller monitor the ILAS final approach. In

such cases the controller merely advises once in a while that "You look good on our scopes, on center line, on glidepath" or perhaps "You appear to be to the right or left of the center line." Remember, the comments from the GCA controller are advisory only, and you are flying the aircraft using the ILAS as your primary low approach instrument.

Look, No Hands

Now that wasn't too hard to take, was it? Of course you are probably wondering what that yakking about auto-pilot and "look, no hands" was all about. Well, we saved that 'til the last because it's the best.

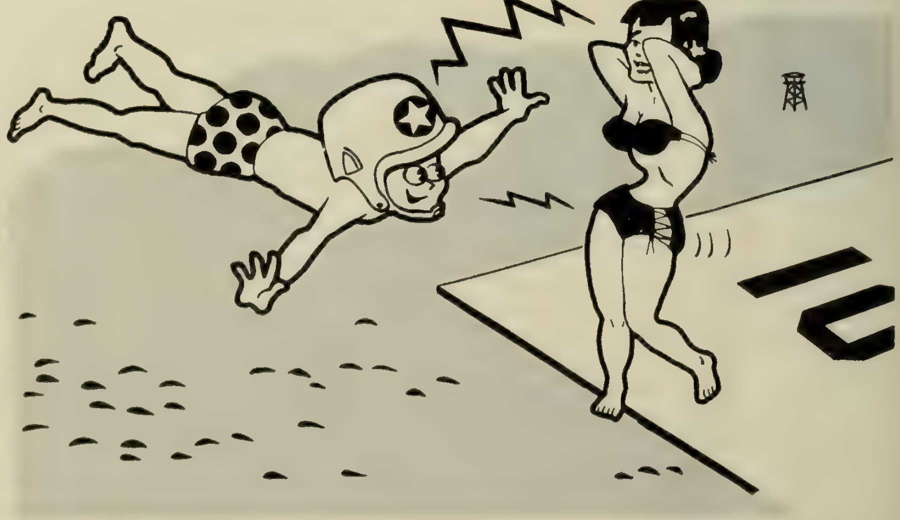
Most everybody is familiar with the auto-pilots installed in fighter interceptor aircraft. They are installed to relieve the pilot from manipulating the controls. This auto-pilot will hold the aircraft on any pre-selected course, change the course at will with a coordinated turn, or maintain the airplane level or in any desired angle of climb or dive up to 40 degrees from level flight. The pilot establishes the desired attitude and heading, engages the auto-pilot and puts his hands in his lap.

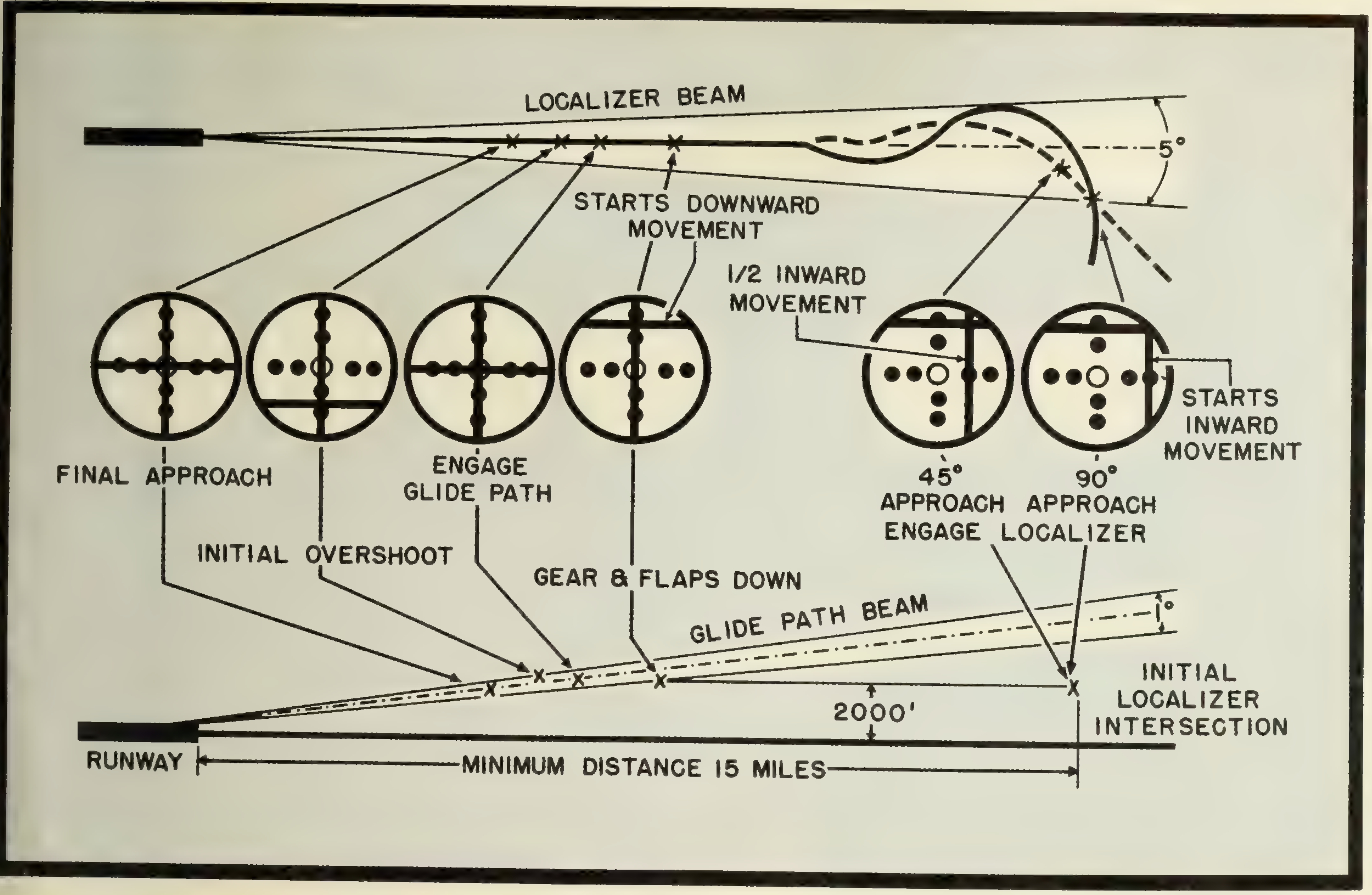
Now you should know a little about the ILAS procedure and a little about the auto-pilot. And here's the best part of the combination. You can use the auto-pilot to fly you automatically to the Omni station or down the ILAS glidepath or both. It's all done with what is known as the automatic approach coupler. In this system the auto-pilot uses the signals received through the automatic coupler to guide you to the radio facility.

Let's say you want to drive into an Omni station. To use the approach coupler to track inbound to the station, you first select the proper heading on the course indicator, making sure you have a TO indication in the ambiguity window. Next manually direct the aircraft toward the desired heading until the vertical needle is within plus or minus one-fourth inch of center position. The heading control will be automatic by engaging the localizer button on the approach coupler control and it will take you to the station.

When you get close to station passage it will be necessary to dis-engage the coupler and fly manually. The reason is that as you near the station, the vertical needle starts to dance back and forth. So will your aircraft

A low approach with the automatic coupler is "Look, no hands."





Needle positions on the Course Indicator are shown in relation to aircraft position during an ILAS pattern.

if it is still on auto-pilot, and things get a little shook up for a while. It is simply a case of the auto-pilot trying to keep up with the dancing needle.

ILAS With Coupler

After station passage the automatic coupler may be re-engaged by selecting the proper outbound heading on the indicator and pushing the localizer button.

Although the automatic coupler can be used to make a penetration, most drivers fly the aircraft manually. Selecting the outbound and inbound procedure turn headings and engaging and disengaging the auto-pilot requires more work than flying manually.

After procedure turn and station passage, change the Omni range to the ILAS frequency and take up a heading to intercept the localizer beam. You can make the initial approach from the station to the localizer beam at any angle up to 90 degrees from the beam heading. When the airplane is on a heading that will intercept the localizer beam and as soon as the localizer needle starts to swing toward center, depress the localizer button. The aircraft will intercept the beam automatically and bracket it until it settles down, right on the money. The auto-pilot will compensate for any drift so all you have to do is sit there and get the aircraft set up for the final approach.

A few words of caution. Do not depress the localizer button too soon on initial intersection of the beam. If you are too far out the coupler will not pick up the signal and will probably just turn the aircraft in circles. Conversely, if you engage the system too late, the aircraft will overshoot the beam and bracket excessively. Just remember that as soon as the vertical needle starts to move toward the center you can engage the coupler. Also, during the entire approach be sure everything is functioning normally. In the event malfunction is indicated, disengage the coupler and continue the approach manually.

As you fly inbound and the horizontal needle starts to move down toward center you are approaching the glidepath and the gear and flaps should be lowered. As soon as the needle hits the center position engage the glidepath button on the automatic coupler control and reduce power to the correct setting. The aircraft will nose over automatically and after two or three oscillations settle down on the glidepath. Now the pilot simply maintains the recommended airspeed by adjusting the throttle and rides it down. Remember, the automatic coupler will always attempt to keep the aircraft on the glide path. If you fail to keep enough power on, conceivably the coupler could stall the aircraft out.

The auto-pilot will now take the aircraft right down to the runway. As you cross the threshold, disengage the auto-pilot and round-out and land. Yes, it's too bad, but since the auto-pilot does not incorporate a round-out feature, you'll have to do this manually. Tough life. ●

Big

REMEMBER LAST year's Carol, Edna and Hazel? Each year, as summer wanes, a series of these towering, vicious ladies come dancing over the horizon out of the Caribbean, heading north.

When they are fully-developed, robust gals they can become quite troublesome; their common failing being that they get a little too windy. And when they open up full blast, anything in their path is likely to get tossed around more than somewhat. Especially airplanes. So when the weird sisters open the ball, best move the iron birds to an area of relative serenity.

Flight Service has been delegated the authority to see that this movement, or hurricane evacuation, is carried out in an orderly, expedient fashion. A strip of land, 100 miles wide, stretching along the southern and eastern boundaries of the United States from Mexico to Maine, has been delegated as a hurricane danger zone. Normally, there are more than 8000 military aircraft based at over 100 military stations in this zone which is divided into lettered areas by Flight Service. If a hurricane threatens, the planes must be evacuated inland.

Flight Service appoints Hurricane Evacuation (Hurev) Commanders for each zone in the danger area and selects inland airfields, or refuge bases, to which military aircraft can be flown when a hurricane is imminent. The Hurev Commanders are responsible for preparing detailed evacuation plans, including types and the number of aircraft at each base that will be involved in the movement. These plans are sent to the appropriate Flight Service and ARTC Centers for coordination.

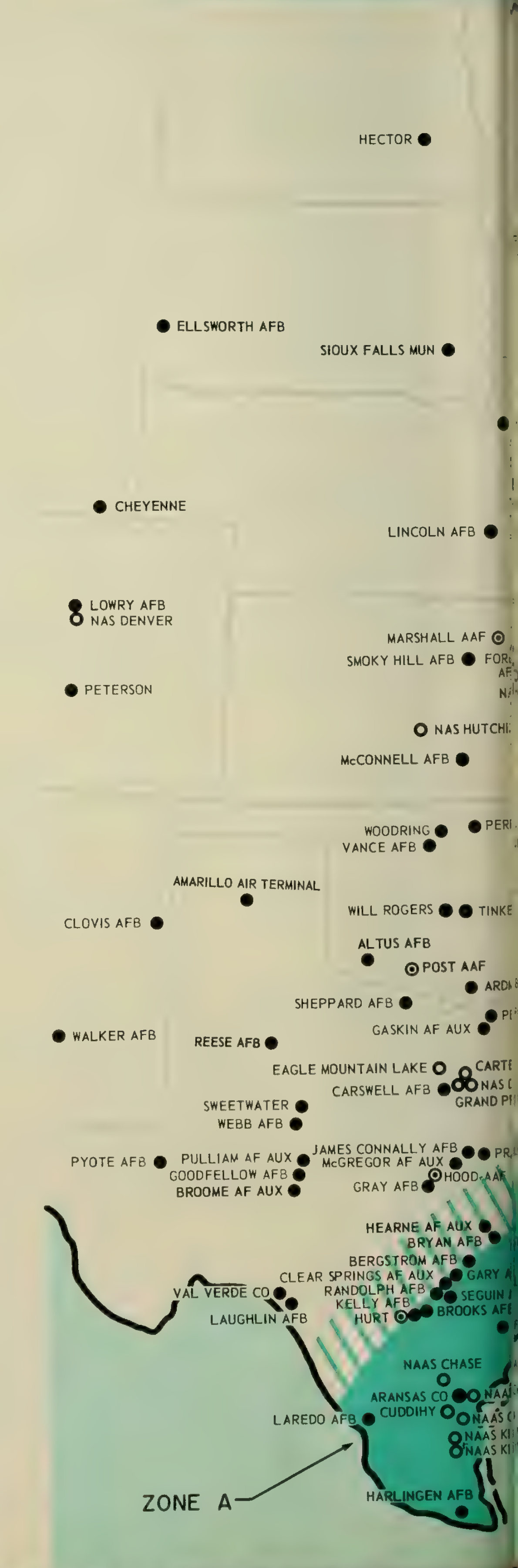
The commanders act as liaison officers to assigned refuge bases also, to insure the adequacy of the facility and to arrange such support functions as billeting, mess and maintenance.

To prevent congestion of air traffic routes and to assist bases in the danger area a Hurev condition system was established. Flight Service Centers keep the bases in their respective areas notified constantly of their present status in the condition system when a hurricane is brewing. Four conditions are possible in the system:

- *Condition Four.* Seventy-two hours prior to forecast arrival. All flight crews and liaison personnel are alerted.
- *Condition Three.* Forty-eight hours prior to forecast arrival. Some of the aircraft are evacuated and liaison personnel are dispatched to assigned refuge bases.
- *Condition Two.* Twenty-four hours prior to forecast arrival. All other aircraft requiring evacuation will be sent out at this time except those whose specific mission requires that they remain available. (Hurricane reconnaissance, ARS and a minimum number of combat ready and support aircraft.)
- *Condition One.* Twelve hours prior to a forecast arrival. Any remaining planes requiring evacuation are sent out. A NOTAM is issued restricting the base to hurricane reconnaissance, ARS and military necessity aircraft. Evacuation of these aircraft will be determined by the agency exercising operational control.

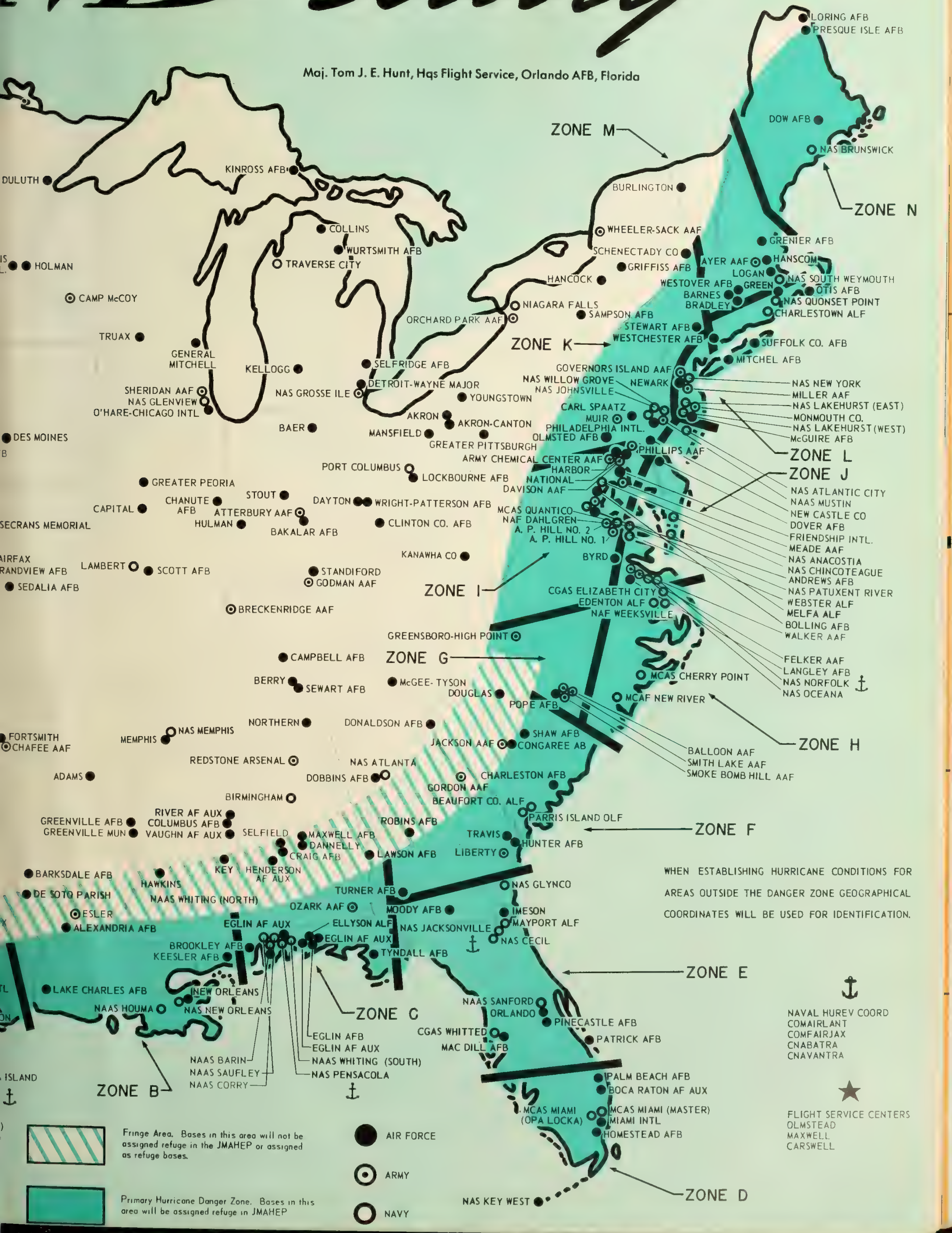
Where possible, evacuation should be made under VFR conditions, in flights. When it is necessary to go IFR, close coordination and cooperation must be maintained between Flight Service, CAA and other interested agencies. On an IFR evacuation, during Hurev conditions one and two, the base will notify the ARTC Center eight hours in advance of the estimated time of departure, stating the number of aircraft involved and giving any changes to the existing Hurev plan. Flight plans should be filed with ARTC four hours before ETD, if possible.

The accompanying map on these pages shows the bases in the danger area, the refuge bases, the numbered zones and those Flight Service Centers responsible for Hurev movements. For full details on the evacuation plans as they effect your area, consult the Joint Military Aircraft Hurricane Evacuation Plan 55-1, Hdqs, Flight Serivce, Orlando AFB, Florida. ●



IND Scurry

Maj. Tom J. E. Hunt, Hqs Flight Service, Orlando AFB, Florida



WHEN ESTABLISHING HURRICANE CONDITIONS FOR AREAS OUTSIDE THE DANGER ZONE GEOGRAPHICAL COORDINATES WILL BE USED FOR IDENTIFICATION.

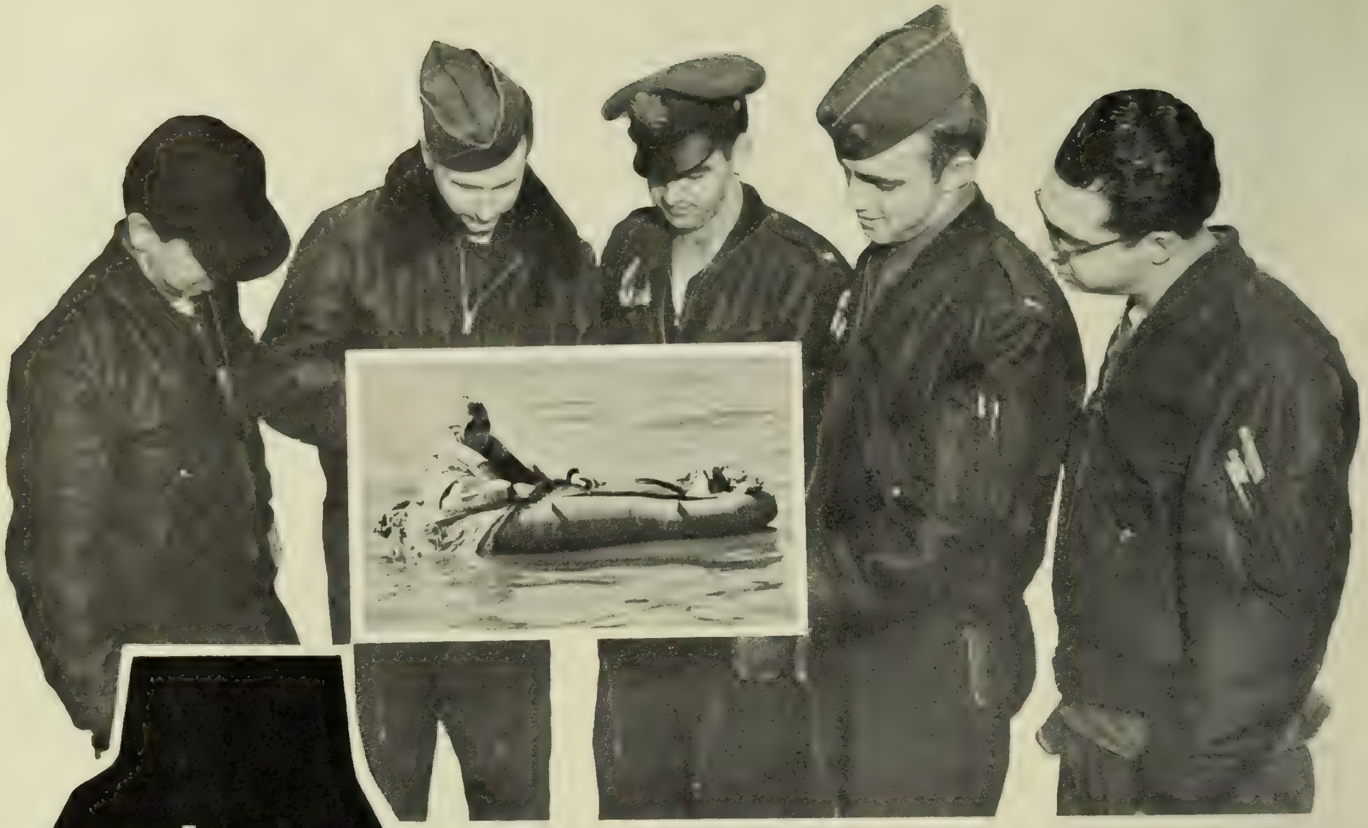
⚓
NAVAL HUREV COORD
COMAIRLANT
COMFAIRJAX
CNABATRA
CNAVANTRA

★
FLIGHT SERVICE CENTERS
OLMSTEAD
MAXWELL
CARSWELL

▨ Fringe Area. Bases in this area will not be assigned refuge in the JMAHEP or assigned as refuge bases.

🟩 Primary Hurricane Danger Zone. Bases in this area will be assigned refuge in JMAHEP

Helping Hand



Typical crew prepares for a search and rescue mission. After specialized, detailed briefings to individual crewmembers, a general briefing of the search area is given by the navigator.

THE CREED of the Air Rescue Service can be stated very simply: "That others may live." Perhaps that isn't very impressive, but just ask the guy who has been snatched up from the wrong side of the bomb line or the pilot who was yanked out of the briny deep. Ask the survivors of a light plane crash high in the Sierras. They wouldn't have lasted out the night without food and clothing from the preliminary air drop. Ask the lumberjack with the ruptured appendix. The H-19 beat the old man with the scythe by minutes.

When the great scoreboard is totaled and all individual case histories are closed, the Effectiveness Reports of ARS personnel will be in the highest brackets.

Basically, the purpose of this article is to remind you how to help Air Rescue Service help you. If the chips are ever down and you find yourself out on the proverbial limb, knowing what ARS needs to know can greatly expedite the helping hand. It takes but a few words to swing this tremendous organization into action and as long as you are in distress, regardless of the nature, you're strictly a VIP and will be accorded the full treatment.

Let's take an actual incident that occurred recently. It represents a typical ARS intercept mission. The report is cut and dried. You'll have to fill in the suspense and a bit of drama by reading between the lines.

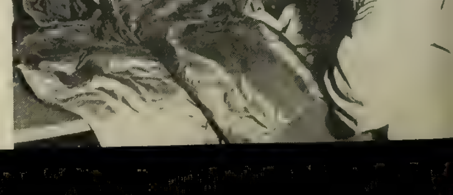
Oakland ARTC advised at 1335 hours that AF-0000, a C-119, was using excessive oil in No. 2 engine and requested ARS to stand by in the event that the aircraft might feather and request interception.

The 41st Air Rescue Squadron was directed to prepare to roll on a moment's notice and a complete flight plan was obtained from Military Flight Service. Armed with this, the crew was ready for a scramble.

At 1413 hours, the Oakland Center advised that the C-119 would have to feather No. 2 in approximately one hour and requested interception. Latitude, longitude and heading of the distressed aircraft were given, and in a few minutes an SA-16 was airborne and winging out over the Pacific.

At 1435, AF-0000 feathered No. 2 propeller and declared an emergency. Oakland ARTC reported that the aircraft was unable to maintain 9000 feet and was descending at 200 feet

Through experience, rescue crews know the importance of having the correct equipment.



per minute. This information was passed on to the Rescue Squadron and a second SA-16 was airborne which, in turn, alerted a task force of 11 destroyers and two destroyer escorts approximately 75 miles from the track of the distressed aircraft. A third alert SA-16 was airborne, with instructions to orbit over the Farallon Islands. This plane relayed weather and sea conditions to the other rescue aircraft.

Although the C-119 was experiencing communications difficulties, VHF contact was made at 200 miles prior to actual intercept and visual intercept by the lead SA-16 was made at 1610 hours. The distressed aircraft had continued a descent to 6200 feet where the aircraft commander was able to maintain the aircraft's altitude on one engine.

The C-119, escorted by all the aircraft, arrived at Moffett NAS at 1823 hours and landed without difficulty. Mission closed.

As we said, this was a routine intercept. It went off smoothly and no difficulty was experienced in finding the C-119. However, here is the information that was transmitted to the Oakland Center and relayed to ARS: Time and position. Groundspeed. Track. Altitude. Intentions. Radio frequencies. True airspeed. Estimated winds. True heading. Number of passengers and crew. Destination. ETA destination. Nature and seriousness of the emergency.

With this information available, it was possible to plan the intercept quickly and efficiently. In other words, the C-119 crew knew how to help ARS help them.

ARS asked FLYING SAFETY to be sure to pass on one especially important factor and that is, *don't wait* for a complete emergency to develop before calling for aid. They know from experience that many pilots are prone to grit their teeth and fight out an emergency situation alone. Possibly they're ashamed to ask for help. Believe us, that's the worst thing you can do. When things start to fall away fast, get on the wireless machine and squawk. The eyes and ears of many agencies are concerned with you and your iron bird. One yell will set the wheels in motion.

It isn't always the military drivers who need help, either. A recent light plane accident and the ultimate rescue of the pilot and passenger from a snow-covered mountain were well publicized by press and radio. It is highly doubtful, however, if anyone outside of ARS knows what went into that particular mission.

At 2010 hours, Hamilton Rescue Control Center notified the 41st Air Rescue Squadron that a light civilian aircraft was overdue on a flight from Oroville, California, to Reno, Nevada. And that, gentle reader, is the worst kind of rock pile country.

The Rescue Control Center received a request from CAA to conduct a search. A full description of the aircraft and flight plan was obtained while the alert crew was being readied for a route search. Weather conditions were forecast to be very good for a night mission.

Because of expected early morning fog at Hamilton and good weather conditions expected at Reno, an assistant mission commander was appointed to proceed to Reno and set up search operations. Another officer was assigned the duty of coordinating the efforts of the California Civil Air Patrol at Marysville, California. A stand-by crew was alerted to provide airlift for the CAP coordinator and pararescue personnel.

Within the next hour and a half, an extended communications check was completed and the following agencies were alerted to assist ARS.

- Ground Observer Corps.
- California and Nevada CAP.
- State police and county sheriffs.
- Many radio and TV stations.
- Newspapers.
- Public utility companies.
- State and U. S. Forestry Services.
- Hamilton, McClellan and Stead Air Force Bases.

The alert SA-16 aircrew and assistant mission commander were briefed on all phases of the situation and given proposed search plans. Basically, the plan was to utilize maximum CAP facilities and personnel, augmented by two ARS SA-16s, one H-19 and all Air Force aircraft flying locally out of the aforementioned AF bases. Other alerted agencies would provide whatever assistance was possible within their capabilities.

The actual search began at 2245 hours, with the suspected areas being combed carefully. Little hills running up to about 12,000 feet made this touch-and-go, and the perspiration of the crews could not be attributed to overworked aircraft heaters.

The following morning at 0815 hours, the predetermined plan began to unfold and a full-scale search was in effect. Maximum effort was expended by all agencies and then one of those unpredictable things happened. A light aircraft not under CAP or ARS control, flying out of Reno on a short cross-country, located the missing aircraft. The pilot of the puddle-jumper could not orient himself navigation-wise to pinpoint the location of the downed aircraft, so the two SA-16s were notified to locate this civilian aircraft that was orbiting the scene.

As might be expected, lack of a common frequency made it impossible for the '16s to home on the light plane and just when things were getting somewhat confusing, Sacramento Radio was able to contact the pilot and told him to proceed to Marysville and land. Soon a plan was formulated to attempt a retrace of his flight path

With the engines turning, crewmembers race toward the SA-16 for a scramble takeoff.

and with the general area established, search aircraft took off again.

Daylight was fast running out when one of the SA-16s located the downed aircraft. A rapid survey of the area and condition of the survivors was conducted. From all indications there was no need for medical attention, but rather, survival gear appeared to be the order of the day. The light plane was upright in approximately six feet of snow, and both survivors were standing and waving. Warm clothing, food, survival gear and a URC-4 radio were airdropped and all equipment landed within a few yards of the two people.

Developing and positioning the various methods of rescue were then put into effect. A triangle of positive rescue methods about the downed survivors was formed as follows:

The ARS helicopter was positioned at Marysville. One SA-16 with a pararescue team aboard was placed at Reno where the weather would remain clear for an early morning takeoff, and a ground rescue team led by two pararescue men hit the trail. This team consisted of county sheriffs, forestry personnel and the local utility company personnel. Their mode of transportation was snow cats.

This activity of the search was slow but very reliable in the event weather imposed restrictions to helicopter and pararescue recovery. The prospects of sure rescue were now well within reach and qualified personnel were in position for the effort.

Waiting for the hours of darkness to pass was the worst. The air-drop of survival gear by the SA-16 eased the apprehension, for it was realized that the two survivors were now well clothed and had food for the night. It's possible to hurry almost anything except the sun. Positive action had to wait for daylight.

At 0632, one SA-16 was airborne from Hamilton, en route to Marysville to escort the H-19 to Auburn, Calif., and then to the scene. The second SA-16 was airborne from Reno at 0830 with the pararescue team. The helicopter landed at Auburn at 0840, awaiting relocation of the survivors. The ground rescue team continued on slowly in their snow cats, toiling upward through trees and snow-covered rocks. In this manner, three possibilities for evacuation were converging on the survivors, each endeavoring to perform the actual rescue as quickly as possible.

At 0956 that morning the SA-16 out of Reno relocated the crash site and radio contact was made with the survivors. Anyone who has ever had to use the little old URC-4 can appreciate just how well the trans-ceiver works. The needle-in-the-haystack is a relatively large object compared with a sport plane down in the mountains, and radio contact with the survivors took the guesswork out of relocation. Both reported that they were warm and in good physical condition. While the first SA-16 orbited the crash, the other began escorting the H-19 to the scene.

The chopper arrived at the site at 1026 and, evaluating the area carefully, the pilot evacuated the two people successfully at 1040. His evaluation of the pick-up makes for interesting reading:

"With minimum fuel, three crewmembers aboard and grossing 6546 pounds, the area was surveyed by making three passes into a five-knot wind, approaching a hover but maintaining translational lift. It was determined a hover could be made at the 5200-foot elevation. The terrain was quite rough, situated on a high bluff, and was moderately wooded and brushy.

"A slow, shallow approach was made and the aircraft was hovered with the gear in the snow. The medical technician got out and led the survivors to the helicopter. After all were on board, the return trip to Marysville where an ambulance was waiting was quickly accomplished."

The SA-16s were advised to return to Hamilton AFB and the ground rescue party was contacted by radio and told to call off their end of the endeavor. Their position at this time was five miles from the scene.

All aircraft in the search and ultimate rescue returned to their respective bases and all agencies were dealerted. Mission closed.

We have to admit that this whole business sounds rather simple. You just go out and fly around until you find what you're looking for. Call up a chopper. Land. Load your passengers and yank off again. But there's a great deal more to the overall picture than meets the eye. The thinking and planning and coordinating are the variables that are not apparent to the uninitiated. The tremendous amount of survival equipment carried aboard the average rescue aircraft is staggering. The many methods of search and intercept could fill volumes.

A couple of weeks ago, FLYING SAFETY visited the 4th Air Rescue Group, commanded by Colonel A. O. Lerche, at Hamilton AFB. With four squadrons located respectively at Hamilton, March, McChord and Lowry, this organization has a vast area of responsibility. Working closely with ADC, the functions of the two appear almost synonymous until the gong rings, then one scrambles to destroy, if necessary, the other scrambles to save.

Inasmuch as ARS personnel never know whether they'll be called on to head out into the desert, skim over the Rockies or grind long hours at sea, the SA-16s are always loaded with a variety of survival equipment. Everything is designed for easy and accurate parachuting to survivors.

Take a crew forced down in the wilderness, for example. Once located, the ARS crew will drop them a carbine and ammunition, heavy clothing which includes jackets, pants and long johns, as well as gloves,

In case of injury, paramedics will bail out at once and spot-land close to survivors.

The Civil Air Patrol, a USAF auxiliary, is trained by ARS and lends invaluable assistance on search and rescue missions. Their aircraft are best utilized for terrain search operations.

boots, sox, parkas, blankets, food and a portable stove for cooking.

Normally, they'll also receive a radio (URC-4), and yellow message streamers giving whatever instructions appear to be necessary. If there are injuries among the downed party, paramedics bail out and spot-land within yards of the camp. These highly trained medical technicians, as devoted to duty as any doctor who ever came down the pike, are as physically fit as all other paratroopers.

Sea rescue presents problems peculiar to that medium. It isn't often that we have to ditch these days but there again, *if it becomes necessary*, try to get word to someone—anyone for that matter—then play your cards as carefully as possible. Regardless of where you are, if your "Mayday" gets through, ARS will be on the way within minutes. If you can't squawk because of communications failure, they'll be alerted shortly after your time runs out.

The SA-16s carry a great deal of water survival equipment, too. The droppable PP-1 Kit consists of two 20-man rafts. Actuated by a static-line paradrop, the rafts will inflate on the way down. Because they're secured together by eight hundred feet of line, a bit of bombardiering on the part of the SA-16 navigator insures that they'll hit upwind from any downed party and then drift down where the line can be snagged without lots of swimming, paddling or praying. There's plenty of grub and water and emergency medical equipment attached to allow for a rather protracted sea journey. If the rescue craft splatters the area with sea marker dye, don't be surprised. Makes for easier relocation in case an open sea landing isn't practical at the moment. Remember though, like the famed Royal Mounties, ARS always get their man. Probably you don't realize how important you are!

There are, of course, many reasons why the Air Rescue Service is a tremendously efficient organization, but by and large, the most important factor is training. Training and retraining. Constant crew up-grading. There isn't a single pilot or other crewmember within ARS who can rest on his laurels.

It is highly doubtful if any unit within the structure of the military demands any greater air crew discipline than ARS. And, we don't mean spit and polish, either. On the contrary, rescue is such an exacting business, every man must not only know every phase of his part in the program, but also is required to have a working knowledge of the next man's assignment. Then and only then can a crew function effectively regardless of situation or predicament.

Plane commanders and those being up-graded must practice constantly to assure maximum personal performance under the most adverse conditions. Standardized procedures include proficiency in the following:

Normal and cross-wind takeoff procedures from land. Instrument and night takeoffs. Maximum performance takeoffs with and without JATO. Standard range, GCA and ILS approaches including engine-out configuration. Landing site evaluation. Maximum performance landings.

As far as water work is concerned, ARS pilots constantly practice evaluation of sea, sheltered water and rivers so they will be able to recognize best landing areas. They must have a thorough and efficient knowledge of basic seamanship. They must know and appreciate the limitations of SA-16s in various water conditions. They practice normal and abnormal takeoffs from water and must know how to get the maximum performance from their aircraft, both in sheltered waters and the open sea.

They are experts in abnormal landing conditions which includes night, instrument, glassy and rough water. Ramping and beaching procedures and evaluation of the surf are other factors that they must be able to understand and master.

The various methods employed in actual searches require the greatest coordination between the navigators and the pilots. Many different patterns are used, depending upon the nature of the mission, such as the expanding square, expanding rectangle, creeping line or the combined parallel expanding square search, to name but a few.

The specialists who make up the Air Rescue Service are, for the most part, men who have devoted years of their lives to the organization. Some say that, like death and taxes, you can't escape from ARS. We happen to know that such isn't true. The real rescue man stays because he wants to. He's a highly trained specialist in a tight-knit organization, and the average pilot, navigator or paramedic is in there to stay just as long as he's needed.

We'd like to reiterate some of the things you can do to help ARS help you, if it ever becomes necessary:

- Get the word out fast if you run into a bind.
- If so equipped, turn IFF to EMERGENCY.
- If far at sea or over vast wastes, maintain the same course until advised to change by ARS.
- Don't wait for the full-fledged emergency to develop before asking for help.
- Try to give a complete picture of your position, altitude, speed, number aboard and the nature of the emergency to the nearest contact point. If you can't reach ARS direct, don't worry, the information will be relayed immediately. Above all, play it cool. You've got the best rescue organization in the world working for just one guy. YOU. ●

— — —

FLYING SAFETY suggests that all personnel charged with training, regardless of echelon, obtain and show the new film titled "Know Your Rescue Service." It's available for distribution Air Force-wide and gives a complete and comprehensive coverage of exactly what ARS can and does do. Every pilot and crewmember in your organization should see this 20-minute film.

For a comprehensive rundown on ARS procedures, see the Supplementary Flight Information document. There's a wealth of information in a few pages and such reading is time well spent.

REX SAYS

ONE OF OUR STUDENTS recently got himself involved in a comedy of errors, which fortunately didn't lead to something far more serious. This boy's trouble started as far back as his briefing.

He was scheduled for a formation mission with his instructor in another F-86 and was briefed for 1200 pounds of fuel on his break. The instructor emphasized this point, and told the flight to call if their fuel got down near minimum allowable.

This student evidently made a rather perfunctory preflight of his aircraft. The plane was written up for the tank selector being incorrect (the selector switch had to be placed on INBOARD JETTISON to feed). This discrepancy was recorded in Part II of the Form 1 and a card spelling out the malfunction was placed on the instrument panel. Obviously, the pilot did not check the Form 1 and failed to see the card, as he placed the switch in the INBOARD position before takeoff.

He failed also to check his fuel until the end of the period, at which time he had 450 pounds remaining.

SHARP SIR!
THE BETTER TO CHEW WITH, LAD

Despite the fact that the fuel was lower than allowable minimums according to his briefing, he didn't call the flight leader during the letdown. (The flight leader had 1800 pounds of fuel at this time.) Finally, just before entering the initial, the student informed the flight leader that he had 50 pounds left. The leader immediately brought him in on a straight-in approach off the initial and the faltering tiger made a normal landing on the runway, flaming out as he touched down.

After the aircraft was towed off the runway, a check showed that there was still 240 gallons of fuel remaining in the drop tanks!

REX SAYS: *Man alive, (it's a wonder this boy still is, after that one) our accident prevention people and Ops officers are constantly pounding home the importance of preflight checks, why you must read the Form 1 and the reasons for following SOPs and briefings. This joker made enough mistakes to start a whole file of Form 14s. It's hard to figure why he wouldn't check the Form 1, see the placard or follow his briefing. He probably had other things on his mind, which can get real rough when you're flying an airplane, especially a jet fighter. However, it figures that by the time his instructor and CO finished chewing, he won't be so neglectful in the future.*

Something else enters my mind concerning this near-miss. Seems that the noted discrepancy could be construed as being a safety of flight item. As such, the aircraft should have been carried on a red cross. In short, earth-bound until said gripe was properly corrected.

I WAS LEADING a flight of four jet fighters on an IFR cross-country mission and as a result of some admittedly lousy flight planning ended up over the range with 30 minutes less fuel than I had entered on my flight plan. Not that one goof was enough, I called in and requested a letdown without bothering to tell them that our supply of juice was somewhat critical. I figured that with a normal letdown I had plenty of fuel, which was true, but after being cleared to 20,000 feet I received an expected approach time of 1329. Still okay, but at 1328 the tower advised that the expected approach time had been moved up to 1341, then later it was again changed to 1353. Finally, I advised them that unless I received immediate clearance, I would be forced to declare an emergency because of fuel limitations. The next thing I got from the tower was that they couldn't clear me until 1408. At this time I declared an emergency and started my descent. We all landed successfully but not one of us had more fuel than it takes to fill a Zippo.

REX SAYS: *With the current inflation you are now valued at 89 cents in varying amounts of calcium, iron and such. Add to that the cost of pilot training, roughly $60,000, and the total soars to about $60,000.89. Now strap a one-million-dollar airplane to your posterior and the taxpayer ends up with $1,060,000.89 worth of man and machine hustling around the wild blue. Everytime you "goof," you hit Uncle where it hurts. But likewise, everytime you use the old noggin in an emergency, you save money.*

Now, that this guy pulled a few boners cannot be denied. With proper flight planning all of this mess would not have come up in the first place. But his declaring an emergency and executing an immediate letdown is a typical example of how a small amount of common sense results in a large saving.

That ARTC can and does handle a lot of traffic when the birds are walk-

SOLD! .... AND 89 CENTS EXTRA FOR HIS HIDE!
$60,000.00
$

ing, is a foregone conclusion. They really do a job; still there may come a time when it is necessary for you as a pilot to take things into your own hands and pull a "ready or not, here I come" stunt. It is certainly not the ideal situation but if you gotta, you gotta! Let them know what you HAVE to do, then do it.

★

I WAS RETURNING to base having cleared from Amarillo, Texas, to Long Beach, California. Takeoff was at dusk and most of the flight was carried on in darkness. There was a moon but the night was quite black. Since the cited event took place between Holbrook and Prescott, Arizona, the countryside was quite black, too, being sparsely populated and with little lighting on the ground. I was flying airways going west and was at an altitude of 10,000 feet which is the published minimum for that airway in that particular locality. As I approached Winslow, I got ready to make my position report and to consult my computer so as to give an ETA for Prescott.

I used my flashlight momentarily, got my computation and gave a look around. Much to my surprise I saw another aircraft approaching me from the right and at the same altitude. I don't believe he saw me but I managed to get out of his way. I don't know if he was flying local or was going south on his way from someplace to someplace else. He was apparently on a course of about 180 degrees or more and hence if he was using the quadrilateral course system he was at a proper altitude, to wit, an even thousand altitude. After I passed Winslow and before reaching Prescott, I overtook another aircraft going the same direction and at the same altitude as I. In neither case did I see the aircraft until it was almost too late to avoid running into same. It certainly would be advisable, what with all the air travel these days, if all flights were required to be on the basis of an IFR clearance regardless of weather conditions, and they be monitored by ARTC to provide time and altitude separation.

REX SAYS: *Well, you have a pretty good point. There are a lot of pros and cons concerning requiring an IFR flight plan during the hours of darkness, regardless of the weather conditions. I have to sort of go along with the idea especially in controlled areas. Of course the big difficulty is that there is a lot of delay involved in providing positive separation and theoretically, if the visibility is good enough for VFR conditions they figure that you should be able to see other aircraft.*

There are several European countries that require all night flights to be IFR. The United Kingdom is one of them, I believe. I've flown around there and it is nice to know that you are provided separation when the sky is black as ink.

★

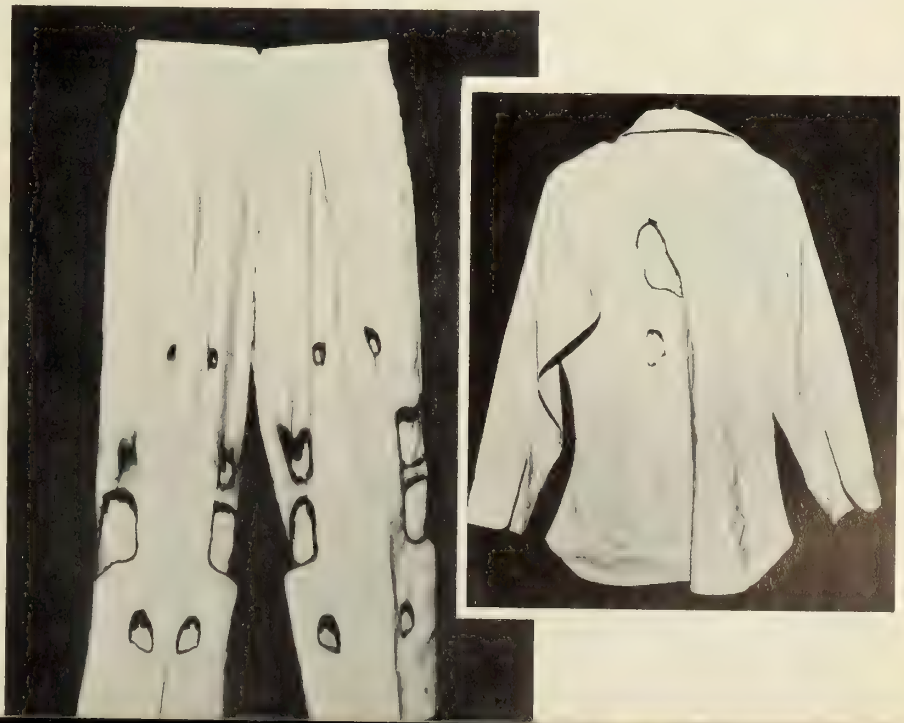
I'D LIKE TO JOIN the parade of "learn and share it" with this little lesson that I learned the hard way. It happened on an administrative flight, B-25 type aircraft with provisions for seating in the waist. Just prior to takeoff, I requested one of my passengers to hang my extra uniform in the aft end of the airplane. He did. The spot he picked may have been convenient but it was also hot.

When the time came to retrieve my neatly pressed uniform, I found that instead of the customary two holes in the trouser legs, there were now eight from which to choose. My shirt too had suffered a slight change in tailoring by way of two gaping holes dead center aft. All liberated material lay charred and crumbling on the aft-section floor and left little doubt as to what happened. That's right, the heater system of the B-25 must be about as hot as Mom's old flat-iron because the results of over-exposure are the same.

Aside from the loss of clothing, I thought of the far more serious series of events that could have taken place as a result of my carelessness. No, I personally didn't hang the clothes next to the heater, but I didn't make sure they weren't hung there, either.

REX SAYS: *Safety is a small thing except when measured by its absence. In this case, its absence could have resulted in an inflight fire of serious consequence. The loss of the uniform was getting off easy. Our newly joined confessor has just pointed this out himself so there's no point in my rubbing it in. But, to belabor the point . . . by virtue of their function, heaters are hot.*

No, this is not the latest garb for the well-dressed USAF type. Actually, it is the result of carelessly hanging a uniform too close to a B-25 waist heater.



that Magic Area

B. A. Martin, Chief Pilot,
Georgia Div., Lockheed Aircraft Corp.

AFTER HAVING FLOWN quite a lot in a little of everything, most pilots are probably in the same boat as I. We're creatures of habit, and habits in this flying business sometimes can and do lead to accidents. I know that I have to watch my own habits closely and you should too. Let me amplify that a bit.

Let's say you've been flying a C-47 for several years. You've been in and out of every pea-patch from Able to Zebra, along with every big field in the country. You've flown in all kinds of weather and made as many night landings as day landings. No sweat. You know your plane and can put it exactly where you want it.

Okay, that's fine, but now let's say that you transition into a larger aircraft. It's bigger and heavier than your Gooney and has four fans instead of two. It cruises faster, carries a much greater load and although it dwarfs the C-47, it's still a kindly aircraft. You learn the plane thoroughly and you get to like it. Then one day you run into trouble.

This is completely unexpected. You're coming in for a landing on a 10,000-foot runway. It's a clear day and the surface wind is almost calm. Two miles out on final you're holding recommended approach speed for the load. One mile out and you know you've got it made. You're all set up. You're coming in real nice . . . then it happens. Before you can lift a hand, the main gear slams onto the ground with a spine-shattering wallop and the big bird bounces back into the air with a vicious leap. You

Fly the aircraft all the way down on the final approach. So far you have merely concentrated on arriving at the magic area at a given airspeed, not on touching down.

slap on full power and somehow catch it before all is lost, but you can't stop the next downward lunge.

The big plane smacks down again. This time it hits on the very edge of the runway and you hold your breath, wondering if the gear is going to collapse. Then you chop power and hold the nosewheel off as long as possible. Finally, after using reverse thrust and tapping the brakes gingerly, you coast to a stop. You're shaking like a leaf and even now, you hate to look over at the copilot. It goes without saying that you are more than thankful that the overrun was relatively smooth and graded and not full of big ruts or chuck-holes. There's about 4000 feet of runway left and you wonder how in the world you managed to hit so short.

Basically, the answer is very simple. Your *habits* got you into the predicament and out again, too. It was habit or reflexes, or whatever you want to call it, that prompted you to firewall the big bird after initial contact with the ground. And it was these same habits that allowed you to complete a more or less successful recovery. In those few seconds your body was responding automatically to messages from your brain—messages that resulted from years of training and experience.

So you say, "Well, how did habit get me into an unsafe attitude? Do you infer that habit made the plane stall out? If so, you're nuts. One doesn't develop a habit of dropping in short. It just ain't habit-forming."

All right. I'll go along with you part way. Normally, short landings aren't habit-forming but it was a habit that caused you to hit short, and this was something that developed 'way back in the days of your early instruction.

Let's take a Dash One for any airplane. Look up the recommended speed for the landing pattern. You'll find tables for varying loads. Okay so far. Now, note that a speed is established for the approach phase and another slower one for over the fence. Please don't think I'm getting too basic, for it's this over-the-fence speed that can get you into trouble. What we mean by this over-the-fence speed is the IAS as you pass over the end of the runway.

No, the Dash One isn't wrong. You were, when you landed short. Somewhere out on that final approach you stopped flying the airplane. Right at the point where you said, "I've got it made," you quit flying the airplane and started guiding it and then trouble caught up with you. What you actually did was cut the instruments in the cockpit out of your crosscheck and concentrate on visual reference to the runway only.

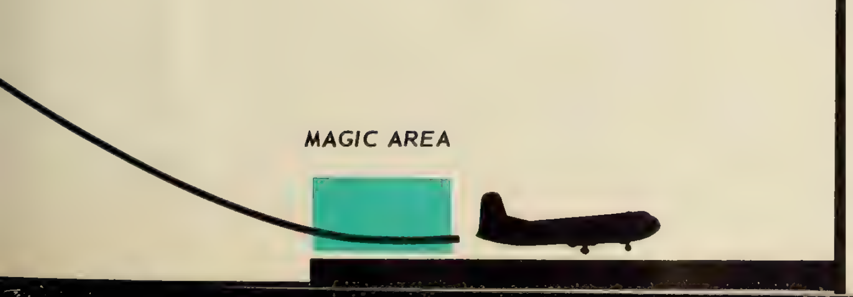
There's one point in every landing pattern that I call the magic area. If you can reach this area while still flying the airplane, your landing will be assured, and I mean every time. Even if you wanted to, it would be impossible to hit short, for when you reach this magic area there is some solid runway under the airplane.

Let's take a hypothetical case. Our airplane stalls at 80 mph so we add 30 mph to that for our over-the-fence speed. In other words, we should arrive over the threshold at 110 mph. This exact speed is all-essential if we're to make the landing properly.

Now let's say the average angle of attack for touchdown is about seven degrees, nose up. This means that we've got to rotate the plane from a near-level attitude to a nose-up attitude through an arc of seven degrees after we reduce power. The average rotational rate is approximately one degree per second.

If our speed is just right when we reach the magic area, all that remains for us to do is close the throttle and rotate the plane until the desired landing attitude is obtained. You will never land short.

Control your airspeed just as when making an instrument approach until reaching that area over the end of the runway.



The important thing is to fly the aircraft up to this magic area and reach it at the correct airspeed. Prior to reaching this area you have not committed yourself to land. All during the approach you have merely concentrated on arriving at this point over the runway at a given airspeed, not on touching down. This means that you must still read the airspeed as well as look out at the runway. When you reach this magic area, then and only then do you start to land.

Whether you bounce or paint it on at this point is not really important, is it? Yet, you will be surprised to find out that you will make consistently good landings because you are making them the same way, every time. Of course, the big thing is that you will never be caught short—of the runway, that is.

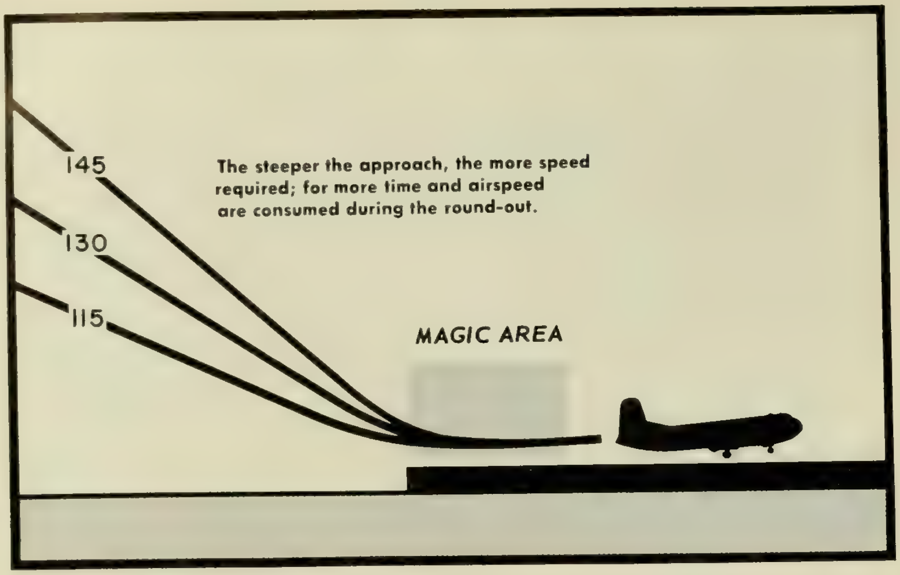
Now, say we cross the fence too slowly. It will be necessary to speed up our rotation rate tremendously if we are to achieve the correct landing attitude before we run out of airspeed and altitude. You know what usually happens in a case like this. Somehow, you just don't quite make it and hit with a vengeance. And, of course, you are setting the stage for having the bird drop out from under you, short of the runway.

Conversely, arriving at the boundary with too much speed results in a period of floating. What the pilot really says to himself then, is, "I can't rotate as fast as usual." In other words, he doesn't have his airplane under control.

So where is all of this leading? It's leading to just this and I repeat: Any pilot in any airplane can make good, safe approaches and landings if he knows his exact speed right into the magic area. Once he has arrived there, and not a second before, can he completely disregard the cockpit instruments, concentrate on the runway and complete the landing, or if necessary, initiate a go-around.

It has been my experience that all too many pilots are prone to watch their instruments carefully until almost to the runway, say a quarter of a mile out, and then at the most critical moment, shift their attention from the cockpit to the runway. They can't tell by many miles an hour whether they crossed the boundary too fast or too slow and every now and again one will fall short and wonder why.

Part of my job has been checking out pilots in Connies. This is a big



The steeper the approach, the more speed required; for more time and airspeed are consumed during the round-out.

airplane with lots of power. It is kindly and forgiving yet I have been amazed at the number of experienced men who make good approaches only to throw it all away when they reached the critical threshold area.

I really don't care what sort of a final approach is made. Long and flat or high and steep. Conditions usually dictate the approach. But the airplane has got to be just as carefully controlled up to the threshold as when practicing instrument procedures.

I believe that one factor often overlooked is that of time. If we have to make a steep approach we carry more speed to insure a controlled flareout. This takes time. Here again, we have to plan ahead. The steeper the approach the more speed required and the more time needed to round out, slow down and hit the magic area at the correct speed. Obviously the area behind must be sacrificed. These are factors that you have to practice yourself. Reading about them won't produce one whit of ability.

One thing that I'd like to point up a bit is this business of airspeed keeping you flying. Remember when your instructor told you that the only thing that kept you in the air was airspeed? Well, actually, that wasn't quite true for the propeller wash over the wings had a lot to do with it, too.

Take a case of undershooting slightly. You open the throttle or throttles and immediately feel the airplane surge. However, if you've ever watched the airspeed indicator under such conditions, you noted what you thought was increased speed was in reality an increase in lift. The increase in power resulted in increased lift provided by the propeller slipstream over the lift areas of the aircraft. The end result, of course, was lifting yourself by your bootstraps.

Along with this idea of flying the aircraft right up to this magic area, never forget that power is your fourth control. You must use it as a control agency just like the surface controls. Use it to help you get and keep the correct speed. It is also wise to remember that you should not chop the power abruptly any more than you jerk back on the stick for landing. When you do you are immediately taking lift away from the wings. Use it like the other controls, smooth and easy.

Now this lift by propeller slipstream actually provides more margin for airspeed error. But today, as we get closer to an all-jet Air Force, we have to change our thinking about such factors quite a bit. In any jet plane, airspeed is your only salvation. Unlike the reciprocating job, you don't have a fan to create lift.

What the man said about airspeed keeping you flying is now perfectly true in a jet. With your indulgence I'd like to speak briefly on some of the jet problems. Testing B-47s has given me a reasonably good insight to this puzzle so, for whatever they are worth, here are my ideas.

One factor that's applicable to any aircraft, but particularly jets, is the critical threshold speed and that magic area again. It's important to be in this area at the right airspeed in reciprocating jobs; it's an absolute necessity in a jet aircraft. As a rule of thumb, you can figure that every five knots above recommended over-the-fence speed will account for 1000 feet of runway. If you come in too hot you'll find yourself fresh out of runway in spite of drag chutes, flaps, brakes or any other aid. Yank up the net, lads, I'm coming through.

This then is really what I've been hammering at. One of these fine days you'll find yourself strapped to a blow-torch for the first time. I predict that you'll love every moment of flying it too. But if you're sloppy about this magic area business, you're in for trouble. You just don't have the leeway to play with in jet aircraft.

Let's take another hypothetical example and see what can happen. This job stalls at 120 knots and we use 130 knots for our over-the-fence speed. Okay, we could build in all sorts of possibilities that might louse us up. Maybe the airspeed indicator is a couple of knots on the high side. Possibly the plane is dirty and our aerodynamic efficiency is lowered by three or four knots. So there's about six knots shot and we don't even know it. Where are we? Just four knots above a stall and that doesn't allow for any horsing around. Let the pilot apply one-tenth of a G at this point and we lose six more knots and that's all she wrote!

Fortunately this is an imaginary case and we never have to fly 'em at quite so critical a speed. But, you can see from the example that we've got to know our airspeed all the way to the threshold. Naturally, in gusty air we'll add a few knots. You do that in a reciprocating job, and the jets are no different.

Unlike your old Goonies and other allied craft, jets have no propellers to act as brakes. I don't mean reversible fans, either. Those big blades present some genuine drag and many a pilot who has landed long can thank his props for getting stopped. By the same token, they've caused some undershoots, too.

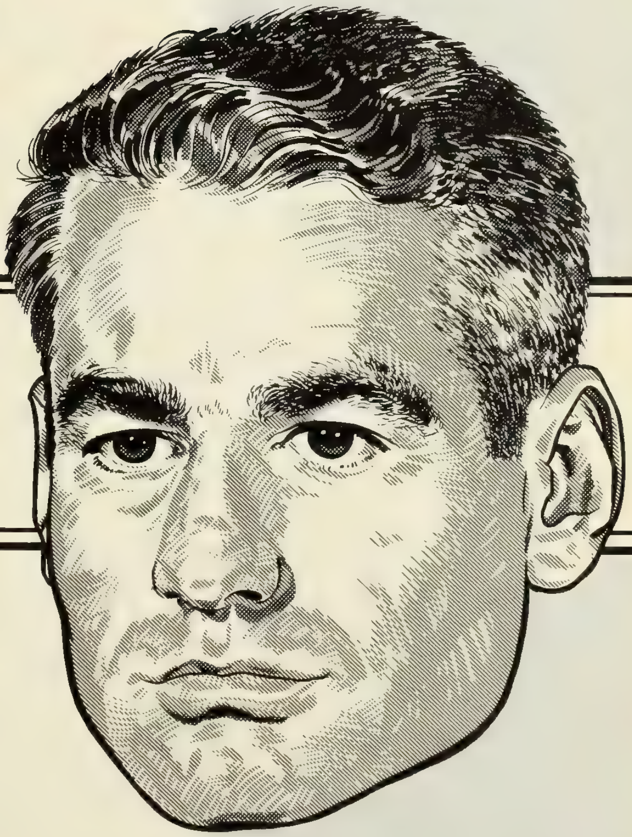
I'm not attempting to teach the mechanics of flight in this brief article. That will come with training and practical application. However, in any airplane, jet or reciprocating, if you control your descent, enter the magic area at the proper airspeed—you've got it made—and not a mile or two short. ●

Capt.

Edward C. Jackett

3215th Drone Squadron
Eglin AFB, Florida

KNOWLEDGE
TRAINING



WELL DONE

CAPTAIN JACKETT was flying a T-33A which had just undergone major modification prior to use in drone operations. The aircraft had been released for the short flight between Eglin and an auxiliary field, minus workable radio equipment.

In accomplishing his check prior to landing, he found that the gear handle could not be moved. All attempts to do so were futile. This not only prevented lowering the gear normally but also precluded using the emergency gear procedure.

Rather than resign himself to a wheels-up landing, the captain mentally searched for a solution. Remembering a recent T. O. change regarding the T-33A gear system, he suspected where his trouble might be and methodically proceeded to make inflight corrections. He first removed the access plate over the gear controls, broke off the gear handle and released the cable. He then removed the gear handle lock pin from behind the gear handle support. It was the lock pin that had prevented the gear handle from moving. Next, Capt. Jackett rotated the gear selector valve to the "down" position, using the rear seat connecting rod. He held the valve in the "down" position during the landing and until gear safety pins could be installed on the runway.

Capt. Jackett's thorough knowledge of the aircraft, and his exemplary ability to think analytically under emergency circumstances, make him well deserving of a "Well Done."

Keep Current

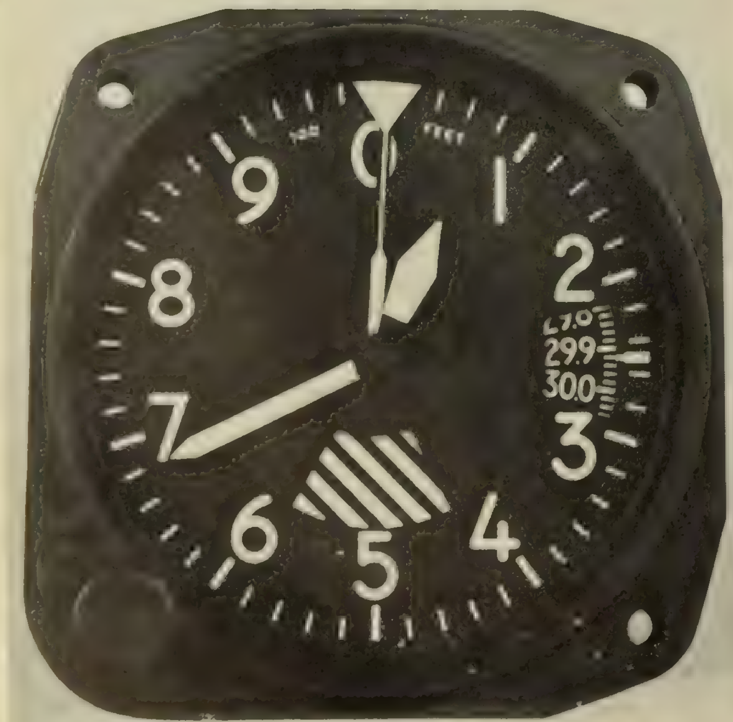
NEWS AND VIEWS

Electronic Weatherman—An electronic weatherman is opening the door to a new concept in weather forecasting. Meteorologists say it is the most significant advance in weather prediction in the last 30 years.

A giant electronic data-processing machine, tabbed the Model 701, will soon be turning out daily weather charts at the Joint Numerical Weather Prediction (JNWP) unit, located at Suitland, Maryland.

Precise mathematical formulas based on the dynamics of the earth's atmosphere are the basis of the numerical system. Electronically calculated, the movement of the air masses which cause weather variations can be predicted with reasonable accuracy by the machine.

Data used by the 701 comes from reports received by teletype from weather stations in the U. S., Canada and Mexico. These reports contain information collected at the various sites by rawinsonde balloon runs. The machine computes the data and then produces charts showing predictions of pressures expected at 3000, 10,000 and 23,000 feet over the United States for the next 24 and 36-hour periods. The pressure at these levels vary as weather conditions vary, and the charts will be used by weather forecasters to predict the weather for their locale.



In answer to many requests from the field, this picture shows the redesigned altimeter dial face, with the 10,000-foot pointer. Present altimeters will be modified to have a window which shows a striped warning sector when a plane descends below 16,000 feet.

The JNWP is a joint effort of the USAF Air Weather Service, U. S. Naval Aerology Branch and the U. S. Weather Bureau under the direction of AWS. Its experts estimate that 64,000 men, working 24 hours a day would be required to forecast weather on a world-wide basis, using the numerical system without the 701 computer.

★ ★ ★

T-37A-Trainer—December will mark the delivery date of the first T-37A twin-jet trainer to the ranks of USAF aircraft.

The twin-jet is a product of the Cessna Aircraft Company and is powered by two Continental J-69 turbojet engines. The USAF will perform an 8000-hour flight evaluation program on the T-37A, starting with receipt of the first aircraft.

Eleven of the little trainers are scheduled to be delivered between December and May, 1956. The USAF is planning for Cessna to go on a six-a-month production schedule in June, with an ultimate goal of 17 aircraft per month.

★ ★ ★

Pogo Planes—"Pogo" planes, like bananas, seem to come in bunches. The latest elevator type job is jet-propelled and with the exception of its "Otis" characteristics, performs like a conventional fixed-wing airplane. The first of its kind to be flown anywhere, the new Bell Aircraft Corp. development uses twin jet engines to provide thrust for vertical operation and horizontal flight.

Unlike the so-called "tail sitter" VTOL (vertical takeoff and landing) aircraft, the new Bell plane takes off and lands in a normal horizontal position, thus eliminating the need for special ground-handling equipment and crews. Two Fairchild J-44 turbojet engines, each delivering about 1000 pounds of thrust, can be rotated from a vertical position for takeoff and landing to a horizontal position for forward flight.

Incorporating a glider fuselage, a commercial light plane wing and a helicopter landing gear, the test model was built as quickly and cheaply as possible to prove the theory. It weighs about 2000 pounds, is 21 feet long and has a wingspan of 26 feet. It carries only the pilot.

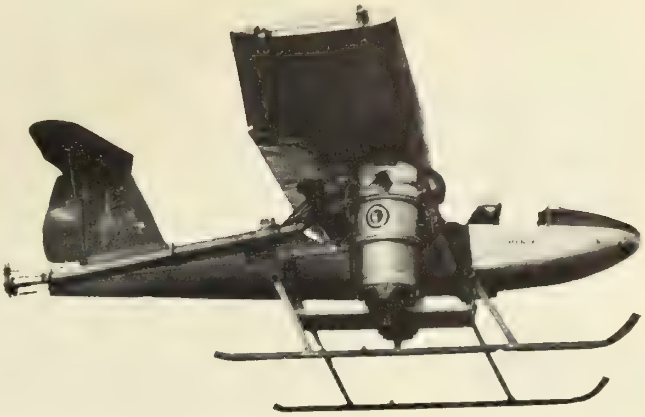
For takeoff and low speed flight, compressed air is ejected from nozzles at the wingtips and tail of the aircraft to provide pitch, yaw and roll control. When sufficient forward speed is attained, flight control is provided by conventional control surfaces, ailerons, rudder and elevators. The test pilot demonstrated complete mastery of the control techniques within 40 seconds of takeoff on the first flight.

Miniature Radar System—The old saw about good things coming in small packages has proved itself again. This time the small package contains the smallest and lightest radar set so far publicly announced. Tagged the APN-59, its miniature tubes and other tiny components, including a five-inch radar screen, are contained in a compact aluminum case only 6½ x 6½ x 16 inches in size, overall.

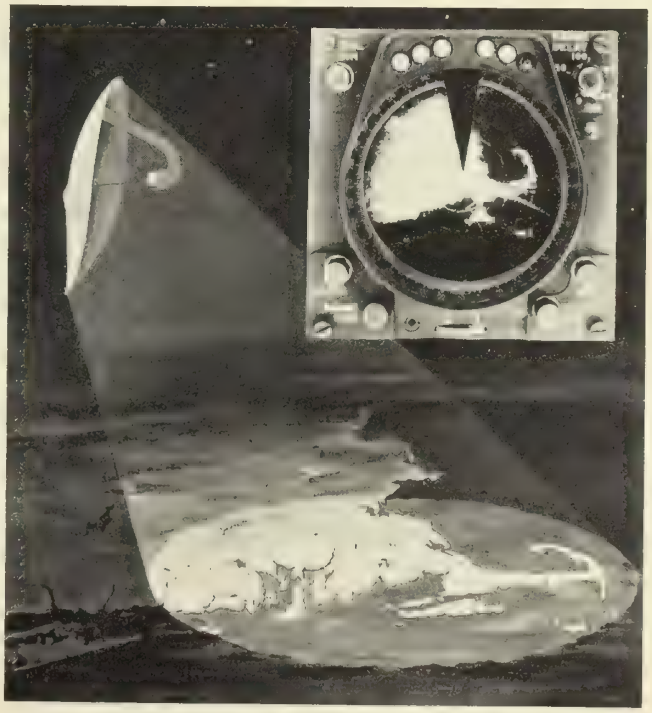
The set has been flight-tested thoroughly, and despite its small size, is capable of "seeing" distances as far as 250 miles apart. The tests further demonstrated that the new unit can be used for any of the following capabilities:

- Two beam configurations - - pencil beam or fan beam.
- Gyro-stabilized antenna - - 18 or 30-inch as space will allow.
- Two types of presentation - - ground pattern or various cloud levels.
- Weather warning - - near or long range search.
- Adjustable contrast of ground pattern - - short and long range.
- Multiple pulse lengths - - automatically applied.
- Radar beacon interrogation and reception.
- Full 360-degree or sector scanning.
- Terrain clearance or to spot nearby aircraft.
- Ground mapping and exact drift measurement.
- Delayed and expanded sweep magnification.
- Pressurized as required for non-cabin components.
- Variable range marker - - plus fixed range markers.
- Remote gyro installation - - used for less space in the radome.

★ ★ ★



Bell's experimental, vertical-rising airplane obtains forward thrust by rotating the twin-jets 90 degrees.



Miniature radar screen shows Cape Cod. Dark wedge at top swings to any heading for exact drift measurement.

Beeper Pilots—This business of flying aircraft with two feet planted solidly on terra firma has received a new boost with some late refinements in the system. The new UHF radio guidance system makes it possible to take off, climb, dive, cruise, orbit and land jet fighter aircraft with split-second remote control. And what's more, the gadget box now has a built-in safety factor in case the control signals should be cut off by ground power failure or bomb damage.

If the drone is below a pre-selected altitude when the carrier signals are shut off, an electronic "brain" takes over the aircraft's controls within five seconds. It establishes a full-power climb of exactly seven degrees, retracts the dive brakes if they are extended and at 200 mph starts a climbing turn to the left until the pre-set altitude is reached. Altitude control is then engaged and the plane is orbited to the left at a constant airspeed until the signal is restored and the plane can be landed.

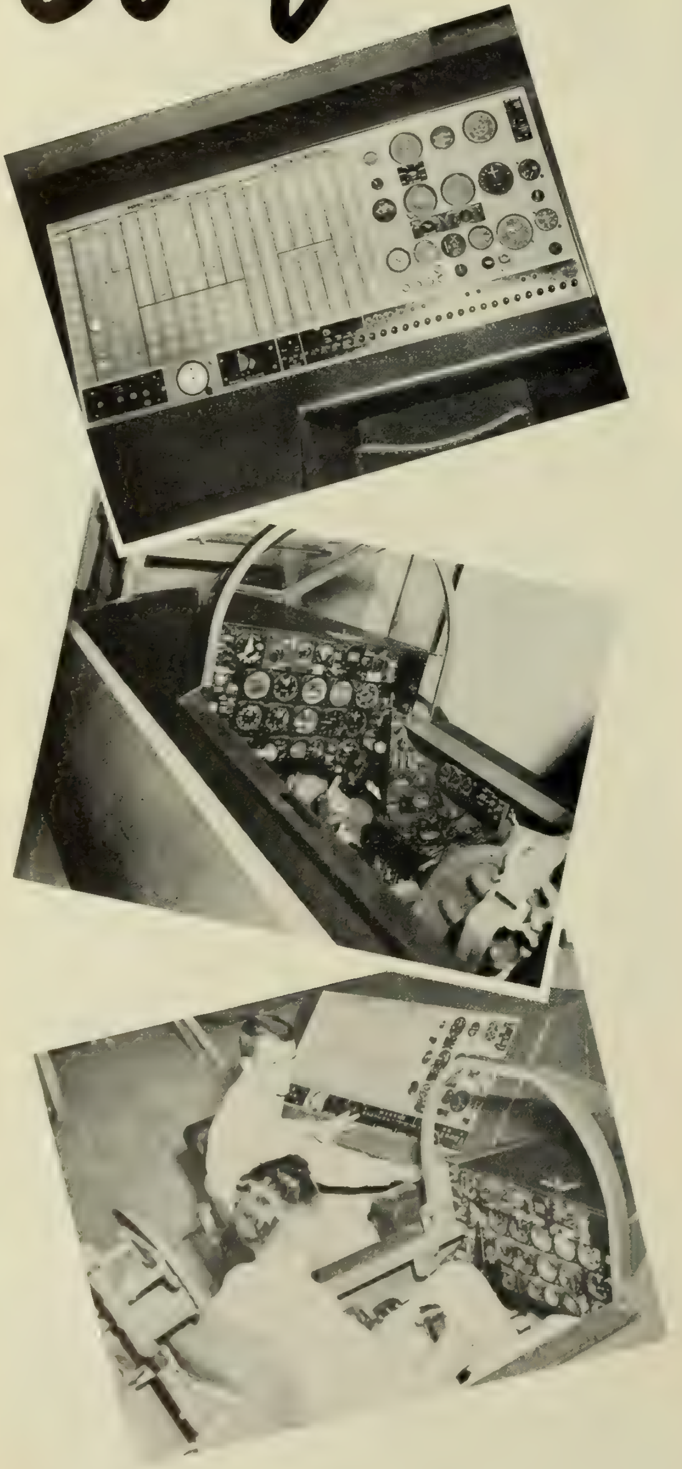
If the signal is lost above the pre-set altitude or during the initial climb-out, the safety device still will control the aircraft to the proper altitude and keep it orbiting until ground control is restored.

The new ground-control system, designed as a standardized production version for both jet and reciprocal-engined drones, is a decided improvement over former beeper methods, and was used during the recent nuclear exercises in Nevada on both the QF-80s and QB-17s which were employed in the tests.

Beeper pilot brings in a QF-80 using the new remote control system designed for Air Force drone aircraft.

VOL. 11, No. 7

Goof and LIVE!



The F-84F trainer is used to teach a student complete cockpit familiarization, for practice in both normal and emergency operating procedures and to instruct in the operation of the aircraft's numerous systems.

HARDLY a day passes without someone giving vent to the old cry against complexity. New airplanes. New gadgets. Gadgets to help gimmicks and gimmicks to amuse and confuse the pilot.

To a certain extent we have to go along with such complaints. However, at long last something has been developed to make the pilot's job a bit easier, rather than more complex. It is called the F-84F Cockpit Procedure Trainer.

Built by Stanley Aviation Corporation, the first '84F trainer is currently being evaluated at Luke AFB, Arizona. Here it should be pointed out that this bit of electronic equipment is not a simulator; it's a trainer.

This unit consists of two separate components. A cockpit which is a duplicate of the F-84F-10 series aircraft and an instructor's console which includes a system of tell-tale indicator lights and cockpit repeater instruments with the necessary controls to operate the trainer.

The scope of this trainer is such as to permit complete cockpit familiarization, afford practice in normal and emergency operating procedures and to allow instruction in the operation of the numerous systems of the F-84F.

The '84F trainer provides realistic simulation of such systems of the aircraft as the engine, engine controls, fuel system, electrical system, hydraulic system, landing gear, flaps and surface trims. All instrument and light indications associated with the systems respond automatically and correctly to actions taken by the student.

The concensus of those who have examined the trainer is that it gives the correct steps in procedures for both normal and emergency operation; that it is a definite asset in getting away from classroom chalk talk; it tends to build self-confidence in a new pilot, and it provides a method to prove to old pilots that there is a need for reviewing emergency procedures. Further it provides a definite test of a student's learning by doing.

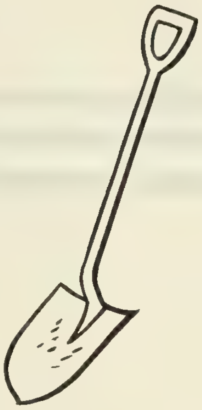
To illustrate the training advantages afforded by this type of integrated design, let's review the operation of the trainer under a "flameout" condition.

This emergency is introduced with the instructor depressing a malfunction switch. As a result, the engine speed will automatically decrease to windmilling RPM, the tailpipe temperature will drop, oil pressure and hydraulic pressure will decrease, the DC generator will cut out, the AC instruments will fail to indicate and the hydraulic equipment will become inoperative.

Okay, here you are at 20,000 feet, hanging by your throat mike and no fire in the pot. This is where the "procedure" business means just that. If the student has the correct procedure down pat, he will go through all steps for an airstart automatically.

Each step of the procedure is followed by the instructor who monitors the successive lighting of tell-tale lights in the "airstart" channel of the console. The situation thus created is realistic and the instructor can monitor and guide the student as necessary.

Although the F-84F trainer that we examined is the first model, word has it that there are more to follow, soon. If the experience at Luke is any criterion, it would appear that the cockpit procedure trainer should have a definite place in the USAF pilot training program. It really simplifies the pilot's job and that certainly is a step in the right direction.



This chick is digging up a little dirt on her approach . . . but she's not necessarily short of the runway.

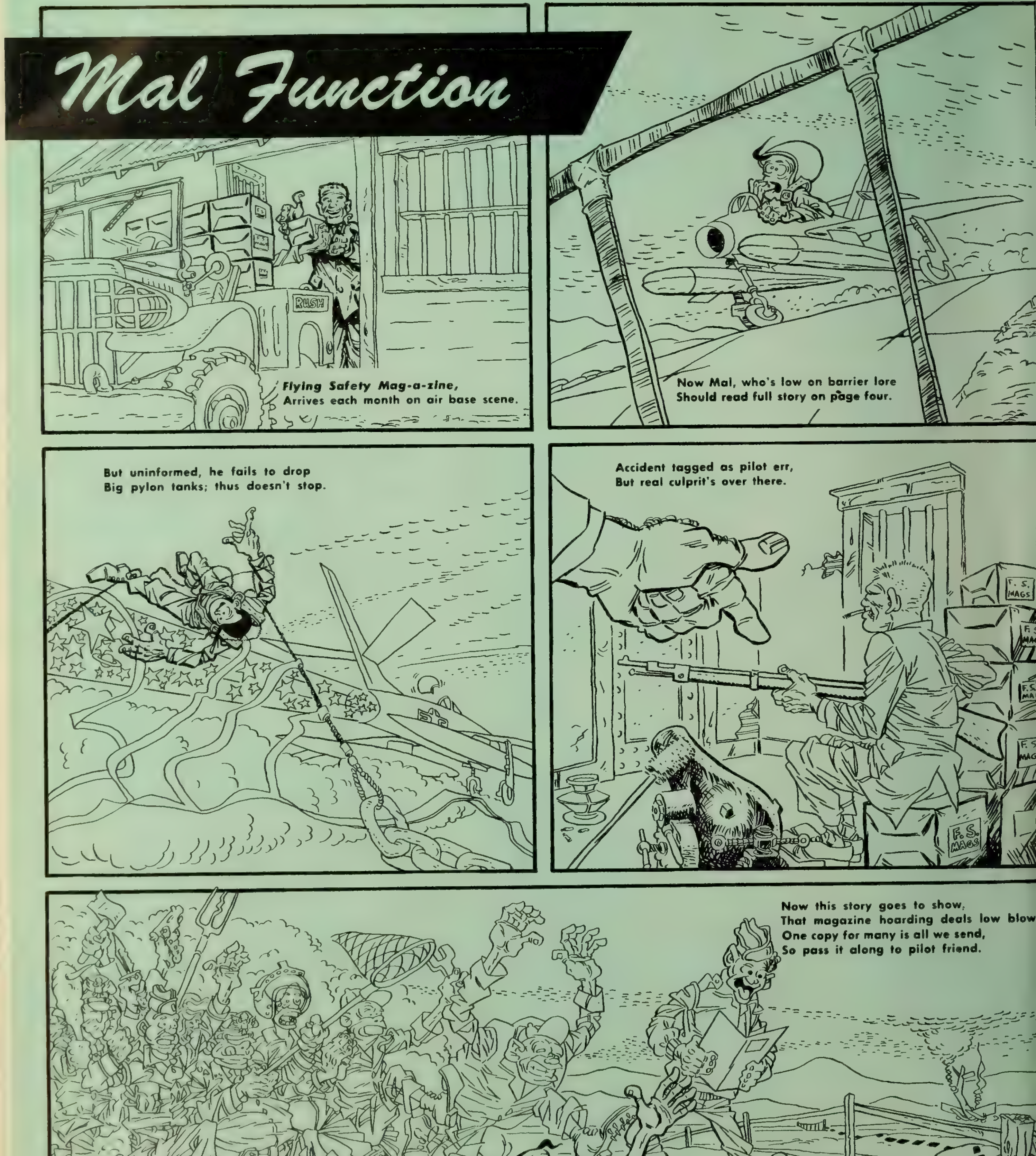
In her case, it doesn't matter; she'll get there anyway. But with you bird drivers, whether you're pushing a jet or a large reciprocal type, it does make a big difference.

This business of touching down short is getting sort of rough and it looks from here as if there can be no excuse but poor flying technique.

Run through the article on page 22 and see if it doesn't make a lot of sense. It was written by a real pro, who is in the know. . . .

Do You Dig It?

Mal Function


Flying Safety Mag-a-zine,
Arrives each month on air base scene.
RUSH
Now Mal, who's low on barrier lore
Should read full story on page four.
But uninformed, he fails to drop
Big pylon tanks; thus doesn't stop.
Accident tagged as pilot err,
But real culprit's over there.
F. S. MAGS
Now this story goes to show,
That magazine hoarding deals low blow
One copy for many is all we send,
So pass it along to pilot friend.
PASS IT ON

★ U. S. GOVERNMENT PRINTING OFFICE . . . 31

629.1305
F-y5

FLYING SAFETY

UNITED STATES AIR FORCE

AUGUST 1955

THE LIBRARY OF THE
AUG [illegible] 1955
UNIVERSITY OF ILLINOIS

Big League Catcher

Page 14

FLYING SAFETY

VOLUME ELEVEN NUMBER ~~SEVEN~~ 8

- Have an article on approach lighting this month that's chock full of info. The gent who wrote it knows whereof he speaks too; lays the reasons why we still have 12 separate systems on the line. Sort of shakes a man up at that.
- Our centerspread, starting on page 14, spells out the results of the latest runway barrier tests made by WADC.
- AWS has contributed an interesting story on the higher altitudes; Flight Service makes a pitch concerning never popular delays, and the high Mach boys get the word on the sonic boom in this issue.
- Next month, provided our roving editors don't get their feet wet, we'll have a report on the 18th Air Force's massive "Operation Gyroscope", featuring C-124s. It will be something a little different than anything we have ever done before.

Department of the Air Force
The Inspector General USAF
Major General Howard G. Bunker
Deputy Inspector General

Brigadier General Joseph D. Caldara
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

STAFF

Editor
Major Joseph P. Tracy

Managing Editor
Captain John H. Moore, Jr.

Assistant Editor
Major Perry J. Dahl

Art Editor
M/Sgt. Steven Hotch

PRODUCTION

Major Ben H. Newby
T/Sgt. Nicholas Shekitka, Jr.
T/Sgt. William H. Johnson
T/Sgt. Carl E. Fallman
Amelia S. Askew
T/Sgt. G. J. Deen
S/Sgt. Al Fortune

CONTENTS

Page

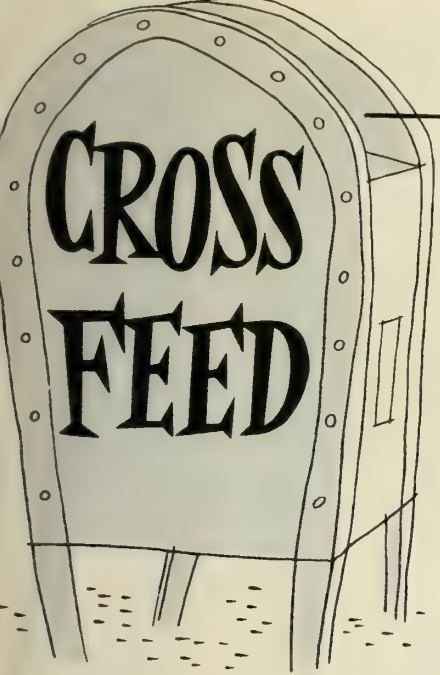
Hazards or Aids? 2
The Soft Touch 10
Stand-by One 12
Big League Catcher 14
Well Done 17
The Low Down on High Up 18
Chilled and Chattering 21
Rex Says 22
Keep Current 24
The Thundering Heard 26

★ ★ ★

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the Flying Safety Magazine. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine,* Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1



LETTERS TO THE EDITOR

Intake Duct Accidents

The engine air intake ducts of jet engine aircraft during ground operation are potentially dangerous to maintenance personnel. This is specially true when you consider that it has been approximately seven years since the first 200 plus pound human "object" was drawn into the intake duct of the XF-86A, and incidents of this type continue to occur.

Technical instructions have been disseminated, signs have been painted, decals affixed and placards prominently displayed to warn personnel of the danger of jet aircraft intake ducts during engine run-up.

Precautions cited in AF Reg 32-3, Subject: "Ground Safety Jet Aircraft Air Intake Hazards," dated 2 November 1948, and T.O. 1-1-309, Subject: "Aircraft Ground Safety," dated 3 October 1952, are applicable to all personnel engaged in physical maintenance of jet aircraft. However, on 18 April 1955, a maintenance employee walked into the intake area of an F-86A aircraft, and was drawn head first into the engine accessory section. The victim was being observed by another employee stationed near the left wing of the aircraft.

It is suggested that this incident be used as a subject matter in forthcoming publication of *Flying Safety Magazine* to again stress the necessity of compliance with established Air Force Regulations and technical publications relative to ground safety in the proximity of ground operation of jet aircraft.

Col. Clare W. Bunch
Actg. Chief, R&A Div.
D/Maint. Engineering, AMC.

We certainly agree whole-heartedly with the Colonel. In fact, recently we saw a mechanic walk a few feet in front of an F-86 that was being run up. How he avoided taking a one-way trip into the intake is beyond comprehension.

The May issue of the AIRCRAFT ACCIDENT AND MAINTENANCE REVIEW contains a fine article on this subject, and we plan to keep hitting the field on the subject in the future via additional articles, posters and accident briefs.

In the meantime, be sure all your people, especially the "new boys," are aware of the dangers involved in standing in front of an intake duct.

Approved Airspace

I am the Air Force Member on one of the four regional airspace subcommittees in the ZI.

It is very obvious that many operations personnel are not familiar with the coordination required for the approval of certain activities in operations within the Air Force.

The following item may be more appropriate for the Operations Brief; however, if some publicity were given this matter in a forthcoming edition of Flying Safety Magazine, then certainly many readers would be enlightened.

"Operations Planner, have you ever been confronted with the situation of wanting some airspace for a gunnery range (you just can't hardly get that anymore!), to change your instrument approach, to move a navigational aid facilities (?), or wondering why THEY let them build that blankety blank TV antenna or water tower so near your base? I have.

"Seriously, who is this THEY person or persons? AFR 55-103 explains the Air Force's responsibility concerning airspace matters with other government and civilian agencies much better than I can here.

"It behooves all personnel involved in operations planning and day-to-day operations to familiarize themselves with the above reg.

"Some time ago a particular AFB in the ZI installed an ILAS, worked out a letdown and all the details that go with installing a navigational aid facility. Today that system is not being used because the installation is in conflict with other navigable airspace.

"Proper coordination under the above mentioned regulation would have precluded this embarrassing situation, not to mention the cost to the Air Force.

Don't let this happen to you, Operations Planner."

Maj. Thomas E. Yarbrough
AF Member, 2d Regional Airspace
Subcommittee, Ft. Worth, Tex.

Chart Holder

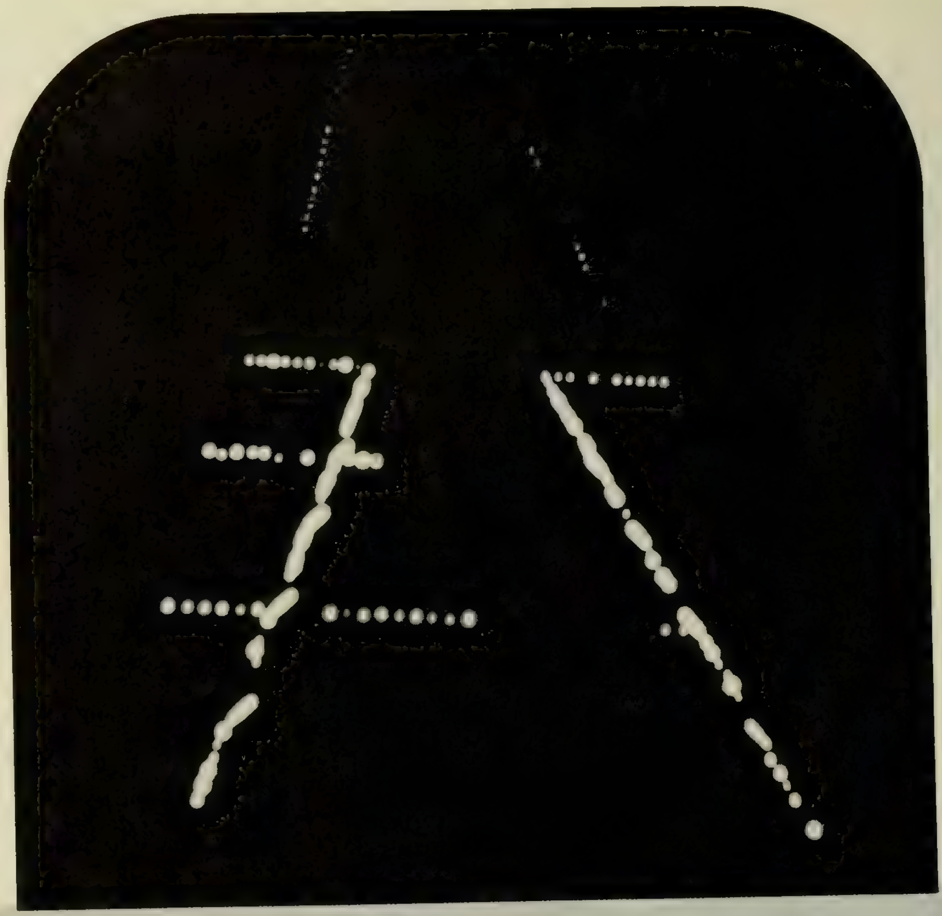
The suggestion of a jet letdown chart holder (Crossfeed, FLYING SAFETY, June 1955 was a good one but the material to be used is not of the proper type. After manufacturing a holder as per instructions, it was noted that it caused the standby compass to deviate eight to ten degrees from normal. This deviation could be hazardous in the event of an electrical failure while on the gages, or if the standby compass was being used as the sole source of navigation.

To eliminate this hazard, it is suggested that the holder be manufactured from brass (brazing rod is available in most welding shops), as it is nonmagnetic and will not cause compass deviation.

The above conditions were noted by Mr. George W. Small (Civilian inspector at this base) in a T-33A which has the standby compass adjacent to the holder location as shown in your picture.

Capt. Barry F. James
FSO, 2347th ARFC
Long Beach Mnpl. Arpt.

And there you are! But the original holder idea is still a good one. Just do as the man suggests and make it out of brass or some other nonmagnetic material.



Sometimes a pilot wonders if approach lighting systems are . . .

Hazards or Aids?

G. M. Kevern, Chief, Lighting Section

Directorate of Laboratories, Wright Air Development Center

Have you ever heard a pilot say, "I checked and they have approach lights, so there's no sweat"? You may say to yourself, "Now there is a guy who considers everything during his preflight planning." But does he?

Ten to one says that if you ask him about the specific type of approach lighting system at his destination, you will get an answer something like, "Who cares, lights are lights, aren't they?"

If he reads the following article, in all probability he will think twice about leaping off on his next night cross-country without first checking to see what type of system he will encounter at his destination. It is important. In fact, being familiar with the system is just as important as knowing if there are any lights installed there at all.

If you are going to take the time to see if lights are available, it doesn't take a minute longer to notice the physical layout of the system. Knowing it may keep you from setting your bird down someplace other than on that nice, hard runway.

DURING A NIGHT landing, have you ever asked yourself, "Am I looking at a row of street lights, runway lights, centerline approach lights or the left hand row of approach lights?" The large variety of approach lighting systems in use in the United States, when combined with inadequate pilot briefing, can cause pilot confusion which sometimes converts a valuable low visibility approach aid into a good-weather landing hazard.

Recently, at the end of a long flight, a pilot was attempting to make a normal VFR landing. He made an approach over what he assumed was a centerline approach lighting system. Unfortunately, the row of white lights turned out to be a left hand row approach lighting system, and the pilot barely managed to pull up in time to avoid landing in the mud alongside the runway.

In another case, a pilot made a good VFR landing between two rows of white lights. Unfortunately, they were slopeline approach lights, not runway lights, and had been installed since the pilot's last visit to the airport. The aircraft bounced across a field, over a highway, through a fence and, finally, up on the runway.

Many similar reports of accidents and near accidents prove the importance of approach lighting standardization and pilot briefing. Adequate pilot briefing is the only immediate solution, as a 10-year construction program will be required to convert all existing approach lighting systems at U. S. airports to any standard which might be adopted.

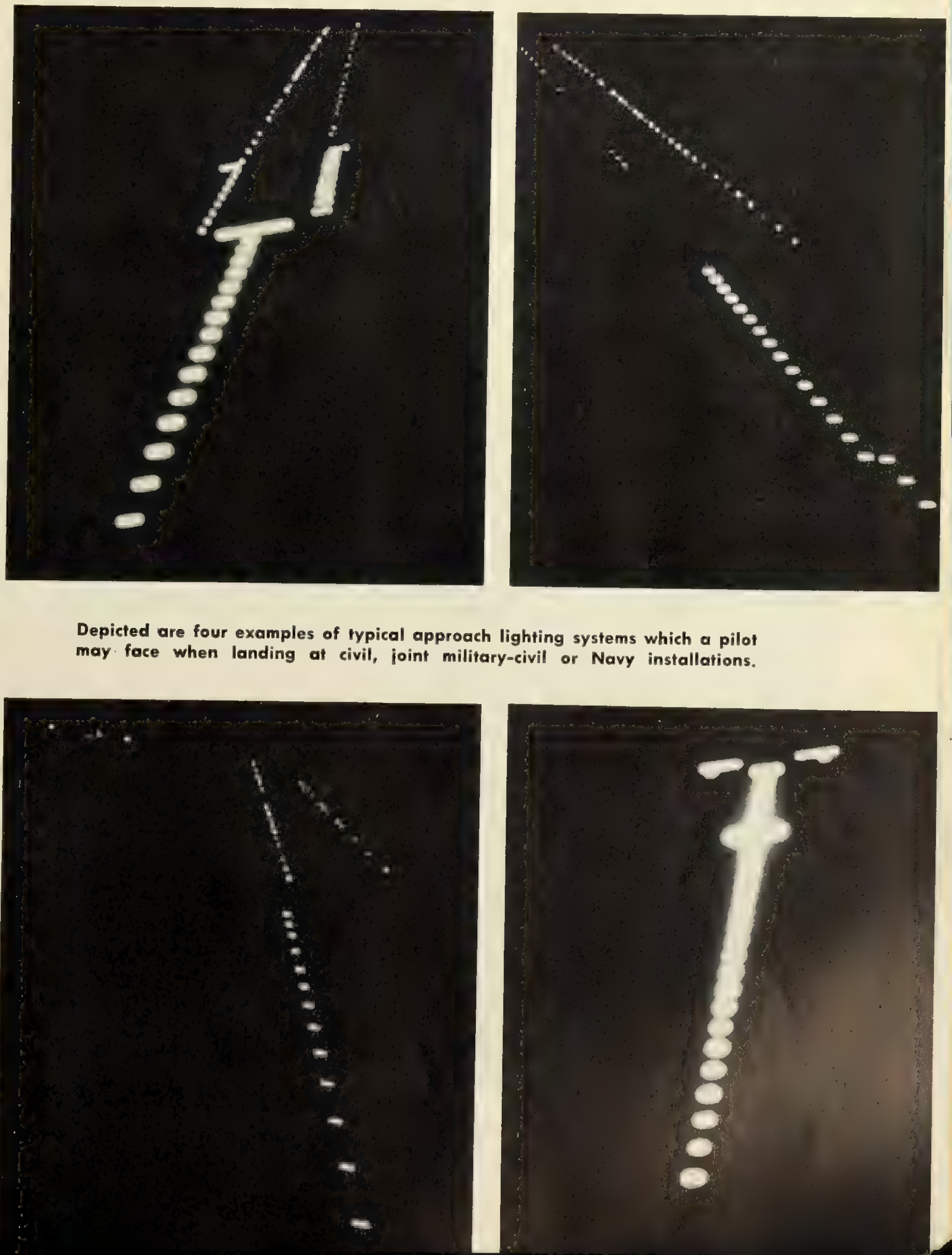
If USAF pilots could confine their landings to Air Force bases, no confusion would exist. Except for a limited number of experimental installations, all approach lighting systems installed at these bases are similar in appearance and use red lights. However, Air Force pilots frequently must land at civil, joint military-civil and Navy fields, and they may encounter, within the continental U. S. alone 12 different approach lighting systems, with great differences in color and appearance. For a safe landing, under either good or low visibility conditions, the pilot should determine in advance the approach lighting system which he will encounter at his destination.

Approach lights are those lights which are installed in an area extending from the runway threshold out into the approach zone for a distance of 1000 to 3000 feet. These lights constitute the pilot's first visual contact with the ground during a low visibility approach, and therefore should provide final alignment and ground reference information.

The minimum visibilities and ceilings described by present regulations are such that approach lighting systems seldom, if ever, perform the function for which they were designed. With the present minima, many other lights are seen in addition to the approach lights. Under these conditions, approach lights merely help to identify the runway and distinguish it from adjacent lighted streets.

Pilot familiarity with approach lighting systems is probably more important than any other factor. Any approach lighting system, whether good or bad, can be of considerable assistance during both good and bad weather if the pilot is familiar with the system. On the other hand, a good system with which the pilot is not familiar can be hazardous.

The brightness of all high intensity approach and runway lighting systems can be controlled from the control tower. Whenever the brightness is considered unsatisfactory, pilots should request that the control tower operator change the brightness setting. If traffic is not too heavy the pilot may request that the approach lights be turned off momentarily. This procedure will serve to positive-



Depicted are four examples of typical approach lighting systems which a pilot may face when landing at civil, joint military-civil or Navy installations.

ly identify an approach lighting system, in the event that the pilot is not sure if he is looking at approach lights or street lights. It should be remembered that excessive brightness will cause loss of darkness adaption, and thereby make instrument reading difficult, if it becomes necessary to pull up and make the transition to instrument flight.

Basic Requirements

At the present time and for many years to come, the only safe solution to low visibility landings will be a properly coordinated system of electronic and visual aids. The electronic aids such as GCA are required to bring a pilot down to the approved minimum, approach lights are required for final alignment with the runway, and runway lights are required to complete the landing.

The function of the approach lights is to provide alignment information immediately and without confusion. During a low visibility landing, the approach lights will be visible for approximately 12 seconds. Furthermore, approach lights must have "wide" in lieu of "narrow" beams so that they will be visible when the pilot is to the left or right of the centerline. This is accomplished by adding suitable horizontal and vertical tolerances to the ideal path established by the ILS or GCA electronic aids. These tolerances are based upon results obtained during actual low visibility approaches. Under these conditions, pilots are under considerable nervous strain and the resulting tolerances are appreciably larger than those obtained when one pilot is under a hood, and a safety pilot has unrestricted visibility.

Approach lights must not constitute a hazard to aircraft which may under—or overshoot. As a result of statistical studies of all Air Force accidents and because the majority of flights are made in good weather, it is believed that cleared overrun areas at each end of the runway are even more important than good approach lighting systems. This attitude prevented the Air Force from utilizing the slopeline system when it was temporarily adopted as the U. S. Standard, and now prevents the Air Force from adopting the unmodified centerline system advocated by the Airline Pilots Association.

Approach lighting systems must also be designed to provide guidance for fighter aircraft which have severe cockpit visibility limitations. A pure centerline system is completely unsatisfactory for low visibility approaches by aircraft of this type. During visibilities of $\frac{1}{4}$ mile or less, no portion of a pure centerline system would be seen if the aircraft flies straight in along the approach centerline. Lights less than 2000 feet ahead of the aircraft would be blanked out by the gunsight or nose of the aircraft, and lights beyond 2000 feet would be blanked out because of the visibility restrictions.

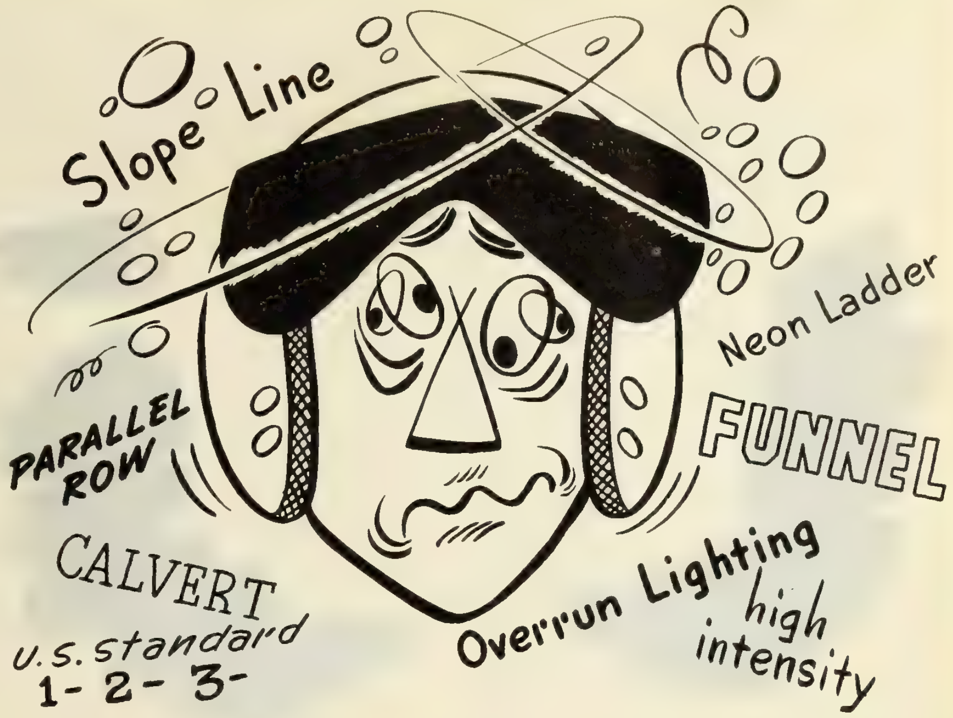
Taking all these factors into consideration has' resulted in concentrating on the development and utilization of an approach lighting system that does not introduce hazards into the overrun area.

During 1946 a joint Air Force, Navy, CAA test program was conducted at Arcata, California, to test the effectiveness of the various approach lighting systems. This location was chosen because of the high number of local fog occurrences. Several hundred actual low visibility landings were made and eleven different lighting systems were put to actual test.

Neon Ladder

Before World War II, the neon ladder type of approach lights was used widely on U. S. commercial

This time exposure is an excellent example of the way that approach lighting systems are tested.



airports. This system consists of a series of neon tubes placed 100 feet apart, forming a 1000 to 1500-foot extension of the left row of runway lights. (See Figure 1.) Each tube is perpendicular to the centerline of the active runway.

With this system a pilot can readily distinguish a lighted runway from the multitude of city lights. The system also clearly distinguishes the approach area from the runway, thus eliminating the possibility of landing in the overrun. During VFR conditions this system proved adequate, however, the low illumination qualities of neon tubes is of little value during a low visibility, instrument approach.

Two Parallel Row

All during World War II, both the Air Force and the Navy used the two parallel row of approach lighting system. These approach lights are merely 2400-foot extensions of each row of runway lights. (See Figure 2.) The runway, approach and threshold lights are distinguishable by different colors. Each light is of 200 watts, and is used without filters for the runway, with green filters for the threshold and with red filters for the approach area.

This type of lighting proved extremely effective in the Aleutian area of operations, even during visibilities down to 1/8 of a mile at night and 1/4 of a mile during daylight. Still, widespread use revealed that certain improvements were needed.

In the first place, pilot confusion resulted from the fact that both right and left approach light rows were identical. When visibilities were so poor that the pilot only saw one row, he did not know if he was looking at the right or the left row of approach lights.

Also, the distance between the two rows was too great. When a pilot is on the centerline, this is not important. But under actual bad weather flying conditions, equipment limitations, rough air and pilot strain combine to produce actual flight paths which often depart appreciably from the runway centerline.

Funnel System

The funnel system is composed of 5000-watt lights which give excellent coverage of the entire approach area. (See Figure 3.) It was installed on seven Berlin Airlift bases and was of considerable assistance to that program. The system was considered excellent the first year of Arcata tests, but was found unsatisfactory the second year when four-engine aircraft were used. The larger aircraft could not make the six-degree turn required when the pilot saw and followed only one row.

Slopeline System

This is the highly publicized system invented by Cory Pearson and Jerry Sweet, of the Civil Aeronautics Administration. Figure 4 is a plan view of their system; Figure 5

is an elevation view of a single pair of slopeline lights, and Figure 6 shows how the system appears to an observer on the ideal flight path. This system appears confusing when first seen, but a pilot thoroughly familiar with the system can obtain more accurate horizontal and vertical guidance than can be obtained with any other system.

As a result of Arcata recommendations, the Slopeline system was the nominal U. S. Standard from 1949 until 1953, but few installations were made. The system was considered confusing by commercial pilots. Virtually no Air Force installations were made as this system violates the requirement for no obstructions in the overrun area.

Centerline System

This system cannot be definitely described, as the Airline Pilots Association has suggested many different systems, all designed as "Centerline" systems. The term has been used to designate any system which includes approach lights installed on the extended centerline of the runway. The system currently proposed by the ALPA (as installed at Newark) is superior to the one tested and found inadequate at Arcata because crossbars similar to those of the Calvert System have been added. This Centerline system is not satisfactory for Air Force use because it introduces obstructions in the overrun area and because it is of little value to pilots looking out of the left side of fighters which have restricted visibility straight ahead.

Calvert System

The British (Calvert) System is illustrated in Figure 7. It consists essentially of a centerline with coded crossbars. This system is widely used in Europe, and is one of the systems permitted by the International Standard. The crossbar idea was found so satisfactory during Arcata tests that some crossbars were added to both the slopeline and centerline systems.

Overrun System

This system was specifically developed to meet Air Force requirements (clear overrun area and visibility from fighter cockpits), and to eliminate the deficiencies of previous systems exposed during Arcata tests.

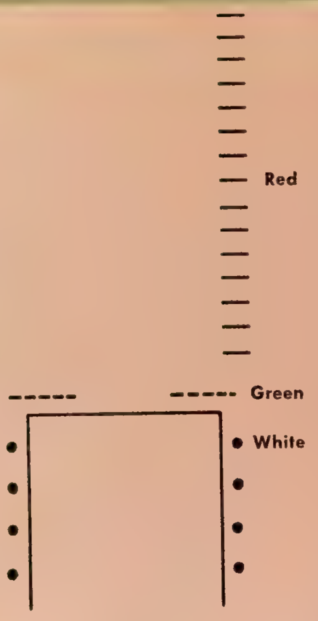


Fig. 1
Neon ladder

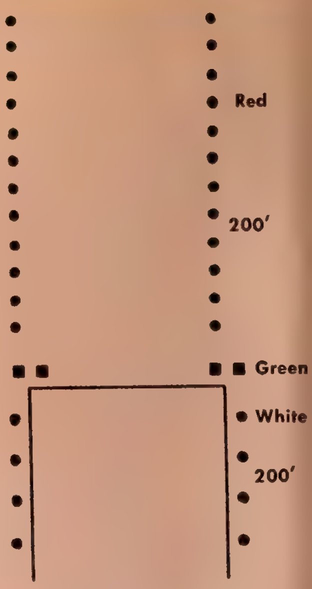


Fig. 2
Two parallel row (AN Standard WW II)

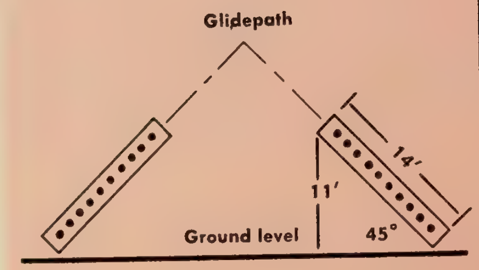


Fig. 5
Pair of slopeline fixtures

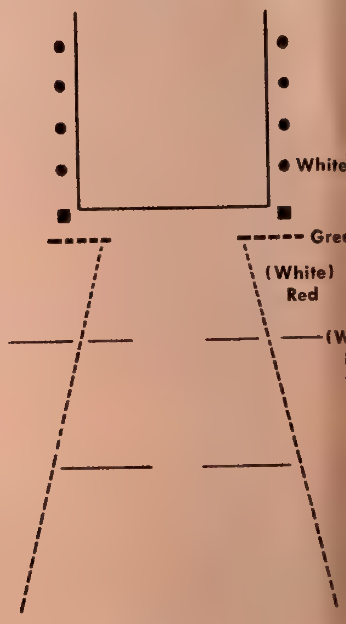


Fig. 6
Slopeline (viewed from glidepath)

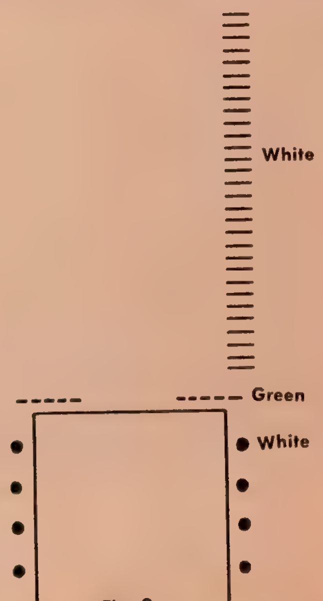


Fig. 9
Left single row high intensity

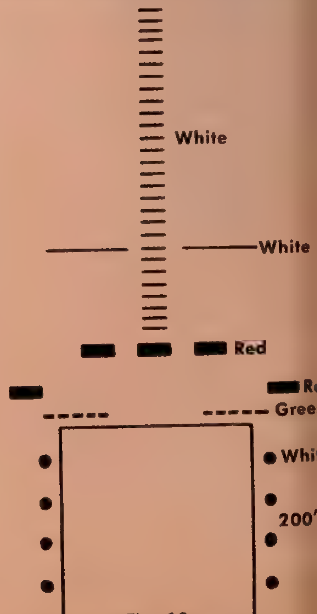


Fig. 10
Figure A of U. S. standard

It is essentially a two parallel row system of red lights 1000 feet long, except that the left row consists of triple lights, and the right row consists of single lights. (See Figure 8.)

High Intensity Single Row

Consisting essentially of slopeline bars laid flat on the ground, this system incorporates an extension of the left row of runway lights, as shown in Figure 9. The majority of systems were composed of white lights, but a few installations used red lights throughout. When the ALPA refused to accept the slopeline, the CAA installed a number of these single row systems which were proposed as a compromise between the slopeline and centerline systems.

U. S. Standard-A

This is the system which the CAA proposes to install on U. S. civil airports. It is the only system currently acceptable to the ALPA. As shown in Figure 10 this system consists of white slopeline bars laid flat on the ground as an extension of the runway centerline, plus red terminating bars. This system does not meet the fighter visibility requirements of either the Air Force or the Navy and obstructs the overrun area.

U. S. Standard-B

This system, shown in Figure 11, was included in the standard at the request of the Air Force. The addition of the centerline extension to the overrun system makes it acceptable under the International Standard and results in an increased overall length which definitely improves the utility of the system. This system meets all AF requirements, as follows:

- Provides final alignment information and defines the ground plane.
- Outlines edges of overrun pavement or compacted ground.
- Presents no obstruction within the overrun area and minimum obstructions on the edges of the overrun area. Overrun lights are essentially 500-watt wide beam runway lights, equipped with red filters.
- The red color makes the system readily distinguishable from runway lights and street lights.
- Positive distinction is provided by the fact that the left row consists of triple lights and the right row consists of single lights.

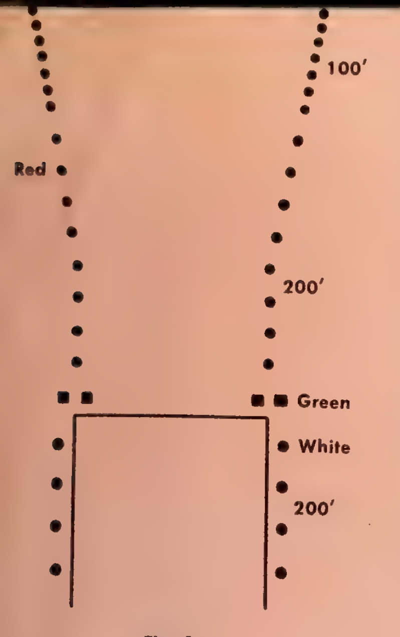


Fig. 3
Funnel system

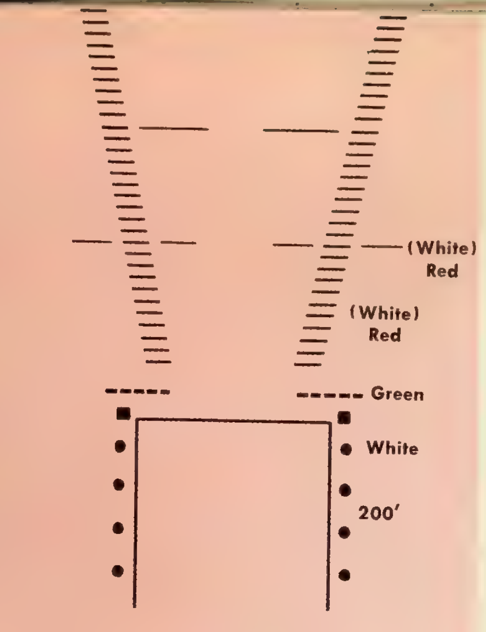


Fig. 4
Slopeline (Plan view)

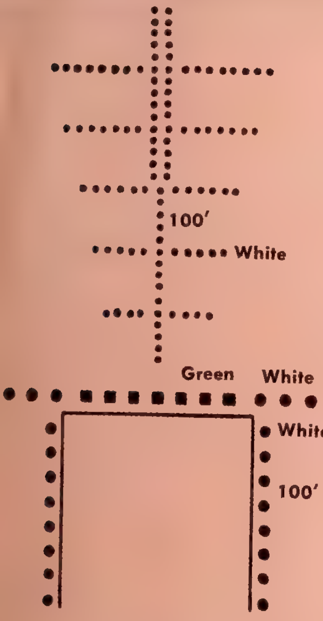


Fig. 7
Calvert system (British)

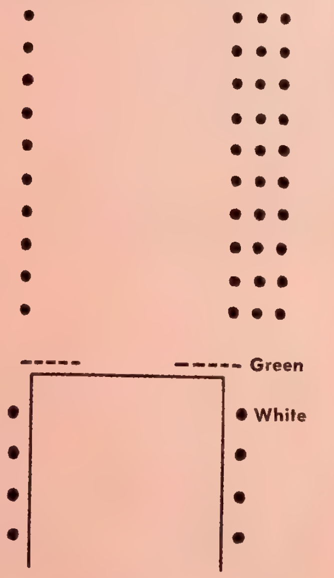


Fig. 8
Air Force overrun lighting system

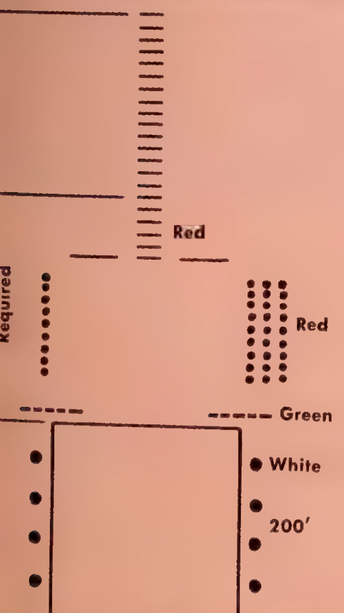


Fig. 11
Figure B of U. S. standard

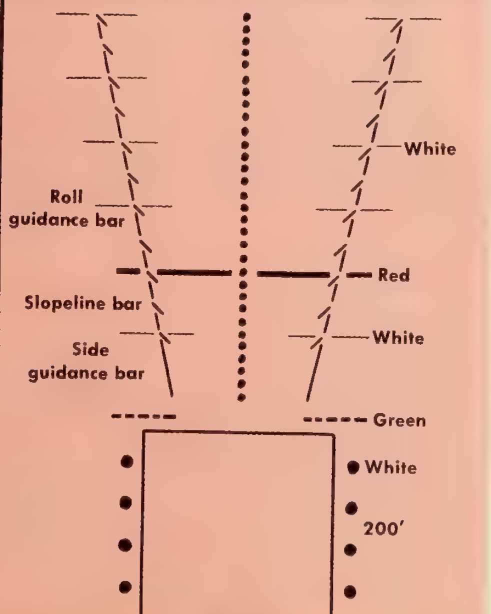
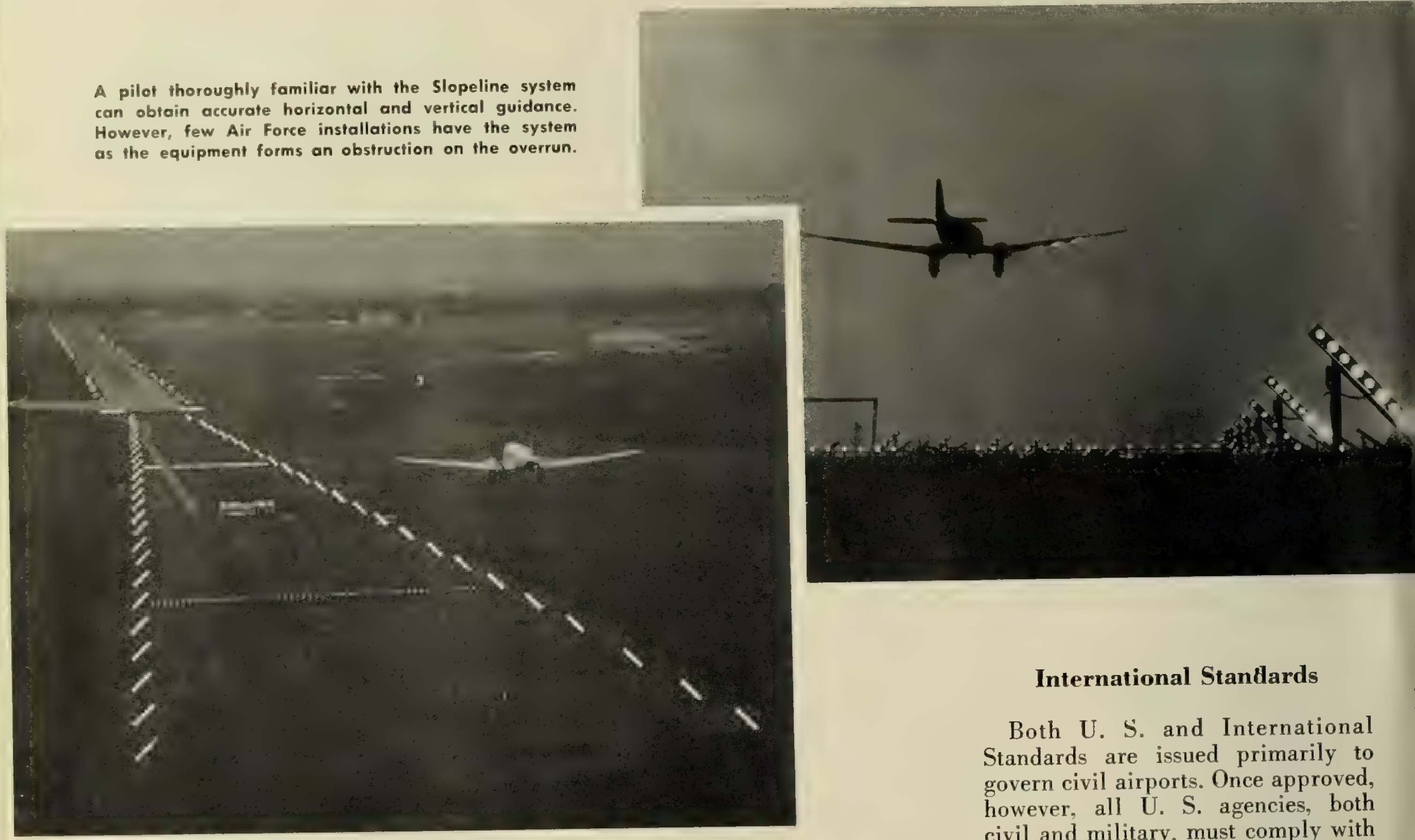


Fig. 12
Figure C of U. S. standard

A pilot thoroughly familiar with the Slopeline system can obtain accurate horizontal and vertical guidance. However, few Air Force installations have the system as the equipment forms an obstruction on the overrun.



- Provides ample light on the off runway side for pilots on the downwind leg and while making the turn for the final approach.
- Provides visual guidance to pilots of fighter aircraft from which pure centerline systems would be invisible during low visibility approaches, because of forward cockpit visibility restrictions.

U. S. Standard-C

This system, shown on Figure 12, was included in the Standard at the request of the Navy. This system is a combination of the Slopeline, Centerline, Calvert and Funnel systems. This system is not acceptable to the Air Force because it is considered confusing and does not provide a clear overrun area.

Existing Systems

Approach lighting systems are permanent facilities, with a service life of from 10 to 29 years. Once installed, an approach lighting system is normally not changed until necessitated by other construction work, such as extension of the runway pavement. The funds for approach lighting, especially civil installations, are definitely limited. As a result, all approach lighting systems which have ever been standard within any agency in the U. S. are still in use at one or more airports. A summary of 403 airports listed in the Pilot Handbook shows that 12 approach-lighting systems are currently in use in the United States. The quantities listed below are conservative, as it is known that there are many approach lighting systems in existence which are not indicated in the Pilot's Handbook.

• No approach lights	288
• Neon ladder	55
• Overrun	22
• Left single row (17 white and 2 red systems)	19
• Two parallel row	14
• Slopeline	4
• Miscellaneous (one each of four different types)	4
• U. S. Standard, Figure A	1
• U. S. Standard, Figure B	1
• U. S. Standard, Figure C	1

International Standards

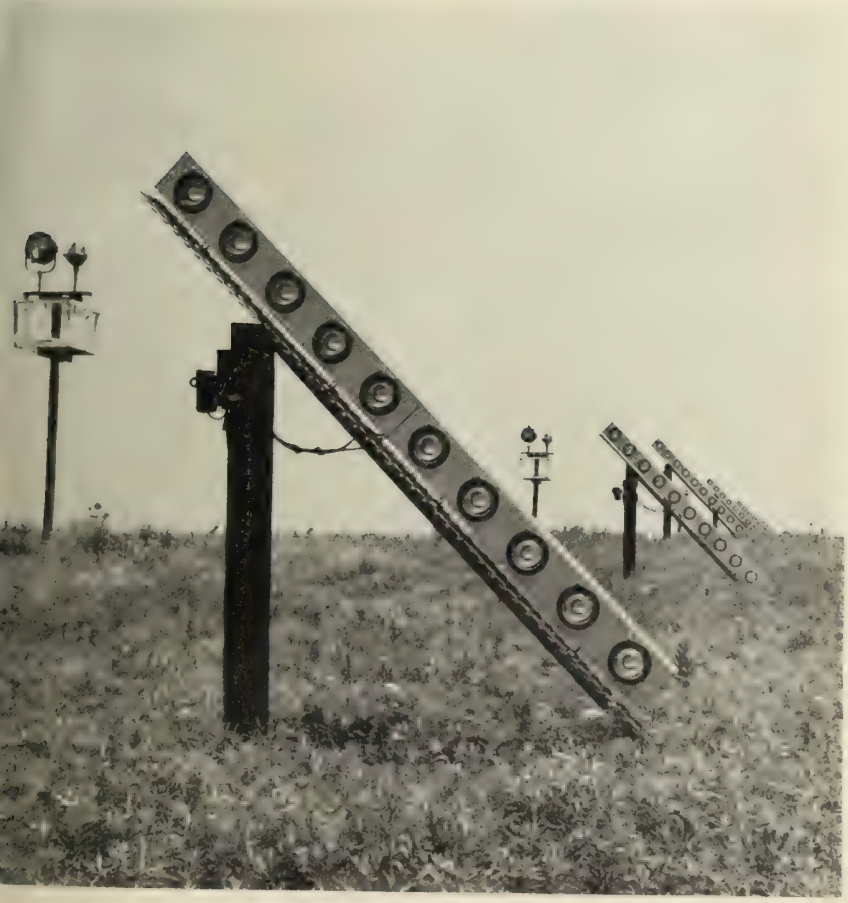
Both U. S. and International Standards are issued primarily to govern civil airports. Once approved, however, all U. S. agencies, both civil and military, must comply with the standards. Special military requirements are ordinarily included as exceptions before the standard is issued, provided that the requesting military agency can submit sufficient justification.

The International Civil Aviation Organization has agreed upon a standard which has been ratified by the U. S. and 59 other member nations. Compliance is therefore mandatory within the United States. The agreement was purposely worded very loosely in order to permit either the Calvert or ALPA Centerline systems. It could be so interpreted as to permit almost any approach lighting system which includes some centerline lights. The U. S. National Standard on approach lighting (No. AGA-NS1) was approved on 4 August 1953, and compliance is mandatory upon all U. S. agencies. Unfortunately this is not a single standard, but contains figures showing three different systems.

Air Force Standards

With the exception of a small number of experimental installations, the Air Force has only three types of approach lighting systems,

Above, tire marks are mute evidence of what happens when a pilot gets confused by approach lights. Below, the Slopeline unit has ten sealed beam lights which form a straight line to the end of runway.



both within the United States and overseas. The three Air Force systems are all compatible. Prior to 1950 the Standard was the Two Parallel Row. From 1950 to 1953, the Standard was the overrun lighting system, which is a Two Parallel Row System in which the left row is composed of triple lights in order to distinguish the left row from the right. The new Standard Air Force system (Figure 11 of the U. S. Standard) is an overrun lighting system with at least 500 feet of centerline lights added to the outer end. This new standard meets all Air Force requirements, and Headquarters USAF has directed that all Air Force bases initiate action to comply with the new standard by 1960, provided that Congress appropriates the necessary funds.

The primary cause of complaints by Air Force pilots is the fact that civil approach lighting systems are usually installed at joint use airports. Although the pavement and lighting extensions are paid for by Air Force funds, civil rather than Air Force lighting standards are used.

As previously stated there are now at least 12 different approach lighting systems in use in the United States. Because of the time and money required to change permanent facilities of this type, several years will be required to appreciably reduce the number of different types of systems, regardless of what standardization action is taken. Implementation of the new U. S. Standard should result in reducing the number of types in use in the United States from 12 to three in approximately 10 years.

Although standardization has been maintained effectively on Air Force bases, such is not the case on civil or joint AF-civil airports. In your flight planning, check the Pilot's Handbook to see which of the 12 existing systems is installed. If the book doesn't indicate an approach lighting system, give Flight Service a call for the latest information. Remember a familiar system is helpful . . an unfamiliar one hazardous. ●

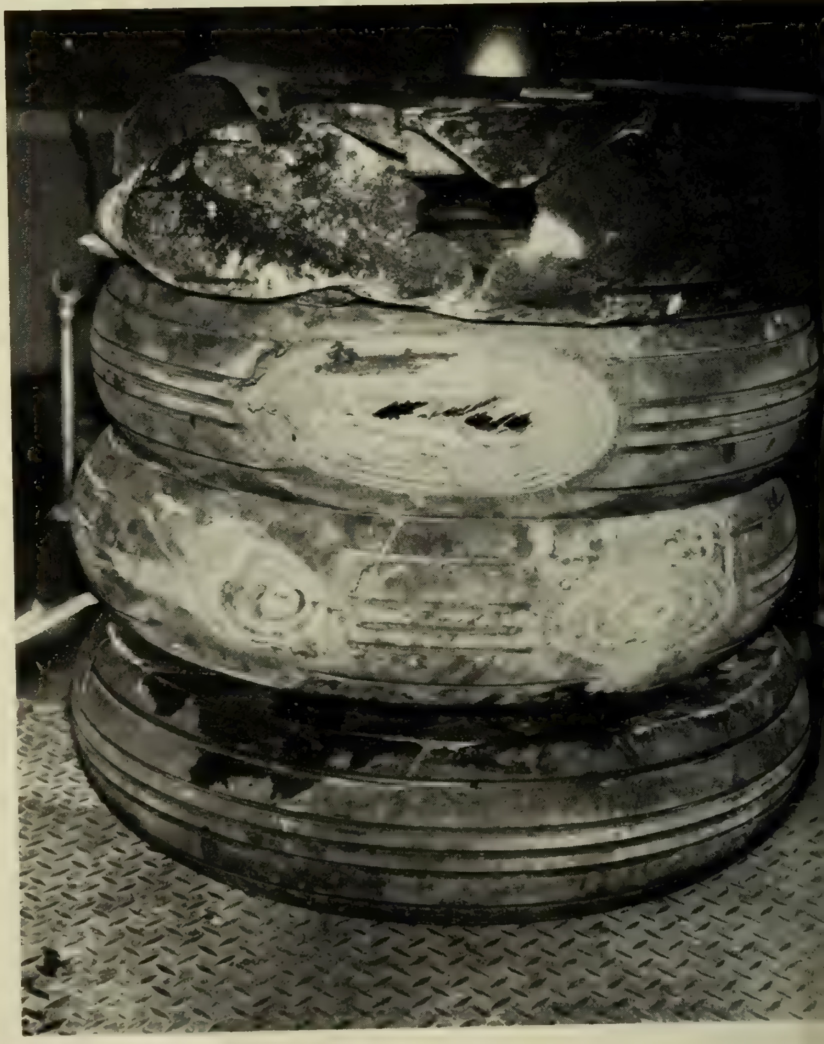
the Soft Touch

E. L. Martin, North American Aviation, Inc.

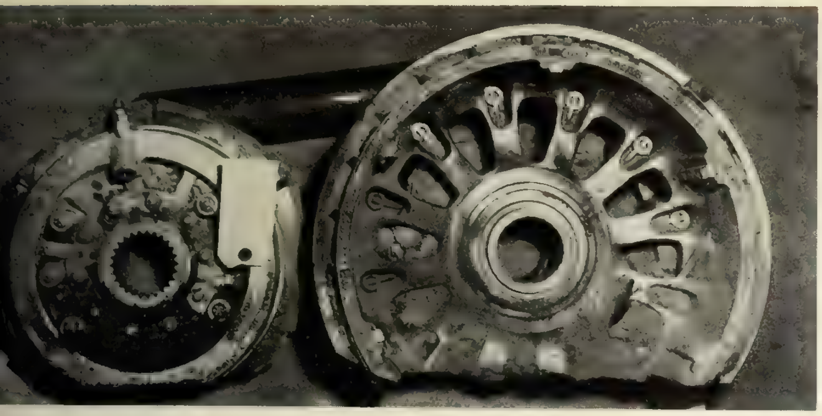
YOU'RE SITTING in your torch at the end of the strip. All checks have been completed. The familiar voice of the tower operator makes you sole owner of the runway and you automatically ease your left hand forward. The anticipated surge of power is there and the invisible pressure pushing you back in the seat feels real good. At first you are aware of your forward motion. There goes the first intersection. The brilliant yellow of a cruising fuel truck catches your eye. There goes the tower in a slight blurr. As your forward momentum continues to build, the world outside your cockpit narrows down to a centerline, a panel of instruments and the horizon directly ahead. Your plane has just reached the unstick speed as you start to ease back on the stick, NOW STOP!

No, this is not an article on how to abort a takeoff. I don't profess to know too much about that but I do know about aircraft brakes. So, I got you into this mess in order to illustrate the terrific amount of heat potential that you build up for your brakes, with every takeoff you make.

You pilots of the modern, fast military airplanes depend more on good brake performance now than in any previous period of airplane development. The reason for this is the higher wing loading and lower lift coefficient current on the thin-wing and swept-wing configurations. This speed increasing combination has necessitated changes in the brake assemblies which in turn has affected the technique required of the pilot in stopping his rolling stock. A good example of these brake changes may be found in the F-86H.



On the landing approach, the pilot will find that the F-86H differs from the F-86F and D, in that the "H," with the "6-3" leading edge, has a higher approach speed due to heavier weight and the lack of leading-edge slats. The fixed leading edge of the F-86H increases its performance at the high speed range but at landing speed, due allowances must be made for directional control and rate of sink. All of these conditions increase the safe touchdown speed of the airplane, which should be around 135 knots, depending on the landing weight. Excessive landing speeds increase the possibility of tire blowouts or failure of the brakes because of excessive temperature development.



Above, when brake locked upon touchdown friction burned through tire, ground wheel away. Left, these tires are four examples of the varying degrees of damage caused by skid burns.

It should be borne in mind that an aircraft brake is a heat reservoir where the kinetic energy of the airplane, because of its weight and landing speed, is converted from foot pounds to BTUs or heat units. Therefore, the basic premise of brake design is resolved by how many BTUs can be absorbed in the brake rotors before the critical temperature is reached.

The amount of heat involved can be explained if you consider the analogy of the airplane accelerating from a standing start to takeoff speed. The forward velocity is attained by virtue of burning fuel in the engine. The fuel represents so much heat in BTUs which is converted into kinetic energy in the airplane. When the airplane is brought to a stop during landing, the reverse of the above takes place and the kinetic energy shows up as heat in the brake. This energy is proportional to the square of the landing speed.

On high performance airplanes such as the F-86H, the landing gear designer has the problem of stowing a wheel that will carry the maximum takeoff load and provide adequate brake capacity. In order to provide a brake that would be adequate for the F-86H and fit within the space available, the Bendix people have developed a new inorganic lining material. It replaced the organic materials used on the F-86F and D. This new brake lining is a cintered cerametallic material. It greatly increases the allowable operating temperatures, thus producing higher braking capacities.

An added advantage of the cerametallic lining is its ability to sustain a constant coefficient of friction throughout the landing run. This eliminates the tendency of the brake to fade at high temperatures.

By necessity, the F-86H brake gained a bit more weight than its predecessors. The brake weighs 80 pounds against 55 pounds for the D series. However, our 80-pound binder is capable of absorbing 9,000,000-foot pounds of energy as compared to 4,900,000-foot pounds for the "D."

Reports from various service activities indicate that there have been numerous failures of the F-86H main landing gear tires. Actually, this tire is larger than that used on the F and D airplanes and has a lower tire pressure. This should normally give longer service. In the majority of cases the tire has been blown shortly after touchdown which indicates that failure may have been caused by one or all of the following:

- Over-braking one wheel to correct for loss of directional control on touchdown. Loss of directional control just prior to touchdown, causes the airplane to yaw and drop one main wheel ahead of the other.
- Too heavy application of brakes.
- Lack of familiarity with the F-86H braking system.

To get the best performance out of the brakes in the H series airplane, follow the normal landing procedures recommended in the Flight Handbook. When the airplane is on the runway, set the nosewheel down quickly and apply the brakes smoothly and steadily to the point just short of locking the wheels; then release and apply brakes intermittently. Hold them on for two or three seconds and off for one second. As the airplane slows down, heavier pedal forces may be applied. If the airplane should yaw during brake application, both brakes should immediately be released and then corrective braking action taken. Here's the reason:

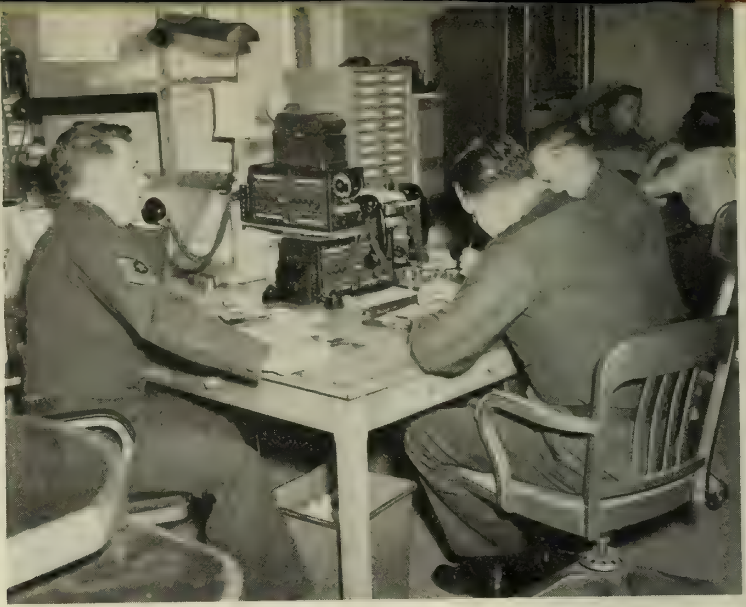
If excessive brake pressure is applied, it is possible for one wheel to lock. The locked wheel will then skid and the tread-rubber in contact with the runway will melt. This reduces ground coefficient of friction and causes the airplane to yaw towards the side OPPOSITE from the locked wheel. The immediate reaction of the pilot is to increase the brake pressure on the locked wheel to correct the yaw. The result will be a tire blowout. Hence also the reason for intermittent braking at high speed; as well as the release of both brakes momentarily should yaw occur. When excessive touchdown speed is avoided and the brakes are used properly in the early stages of the landing roll there is no need for heavy and destructive braking near the end of the runway. Below 90 knots, nosewheel steering is very effective in countering crosswinds. Directional control obtained in this manner helps to reduce brake temperatures.

Remember, an aircraft brake is not designed for continuous operation like an automotive brake. It is designed to stop the airplane safely under the most severe condition, which is an abortive takeoff. Under this condition, the brake absorbs its maximum kinetic energy and attains its critical temperature. If an abort is made, about 30 or 45 minutes should be allowed for brake cooling before attempting another takeoff.

When making repeated landings at short intervals, especially if there are long taxi-backs to the point of takeoff, have the crew chief check your brakes for overheating. A hot brake retracted into the wheelwell is out of the slipstream cooling. The heat absorbed by the brake will radiate to the tire and may cause the tire to burst. Attendant damage to the airplane structure may result or possibly hydraulic lines may be ruptured.

In conclusion I would like to say that you have a good airplane with an excellent set of brakes. Brakes designed solely for your aircraft's individual configurations. Just like any other piece of mechanical equipment that is new to you, you must learn to use them properly and respect their limitations. They'll stop you every time if you use *a soft touch.* ●

Flight Service weather forecasters check the route weather, and brief pilots over the drop-line communications system.



Things can get rather rushed at Flight Service Centers when traffic is heavy, so you may have to . . .

. . . stand-by

THE OLD ROUTINE of being able to simply "get the nod and leave the sod" has become a thing of the past; tactical pilots on a scramble, of course, excluded. Today the pilot making a routine point-to-point flight must take advantage of facilities and personnel available to help him preplan while on the ground.

Once in the air the pilot will be practically on his own, except for air traffic control instructions and he is likely to be as busy as the proverbial one-armed paper hanger just flying, making required position reports, and such. The importance of being thoroughly briefed on weather and NOTAMS, knowing applicable flying regulations and directives, and properly preplanning a flight has increased by leaps and bounds. Aircraft are becoming hotter to handle and safety and security restrictions impose a number of requirements on routine every day flying. Let's face it, if we don't know the routine answers before we get into a plane, there's going to be mighty little time or chance to get them until we land again.

Getting briefed for a flight that originates from your own little base operations is one thing. But it's those flights from fields where there are no operations personnel that often leads to trouble, through the "improper flight planning" route. There is no compromise for good, adequate flight planning and that is why Flight Service has assumed base operations functions at civil airports.

A Flight Service Center is basically a centralized operations office for a designated geographical area. It includes operations officers, weather forecasters and operations airmen. Since these centers are fixed installations on seven Air Force bases, most of their business must be conducted by some means of land-line communications. There are three primary means of doing this:

- The Flight Service interphone party-line type communications system connects the centers with all military flying installations and some heavily used civil airports.
- Civil airports which have CAA Interstate Airways Communications Stations (INSACS) are connected to Flight Service Centers by teletype.
- If neither of the above is available, then a regular long distance collect telephone call may be made to the nearest Flight Service Center.

All information as to availability of the Flight Service interphone and CAA teletype facilities and Flight Service Center area boundaries and their telephone numbers are included in the center pages of the Radio Facility Charts.

Regulations now require Air Force pilots to complete a DD Form 175, including the weather section, when departing on a cross-country from a non-military air field. This form provides a good weather briefing checklist and, when filled out, a pilot has a good idea of what to expect.

Now let's see what happens when a pilot wants to file a flight plan, get a weather briefing and be cleared, using the Flight Service interphone. Depending upon the situation, he will do one of two things: either get a weather briefing and then submit his flight plan, or submit his flight plan and then get his weather briefing. Either will be copied by an airman in the Flight Service Center. The request for weather goes to a weather forecaster. The flight plan goes to an operations officer who reviews it and then passes it to a forecaster who prepares and delivers the weather briefing. The operations officer monitors the briefing and checks for NOTAMs which pertain to the proposed flight. If all is well, the operations officer gives the pilot any applicable NOTAMs, special information and approves his flight. Upon completion of the briefings by the forecaster and operations officer their respective initials should be entered in the appropriate places on the Form 175.

This procedure is simple, both in theory and in practice, however, the occasional delays experienced by pilots are aggravating and difficult to

Flight Service personnel appraise every flight plan prior to Operations Officers' approval and clearance.

one

Major Gayle C. Wolfe
Hqs Flight Service, Orlando AFB, Fla.

understand. After all you say Flight Service is there to provide the service requested, so what happened? Simply this. Unless you are filing a flight plan between the hours of 2200 and 0500 you will probably have to wait in line somewhere along the procedure for the forecaster and the operations officer. Normally there will be pilots ahead of you, filing from the same station as yourself. There may be another station for which Flight Service clears on the same line. In the Flight Service Center, incoming calls are handled by a number of airmen who may be compared to telephone switchboard operators. Here your message is typed out and passed to either a forecaster or operations officer as applicable. At this point a further delay may be experienced since two or three forecasters and an equal number of operations officers may be briefing and clearing pilots from four or five other bases on the same interphone system in addition to handling teletype and long distance telephone requests.

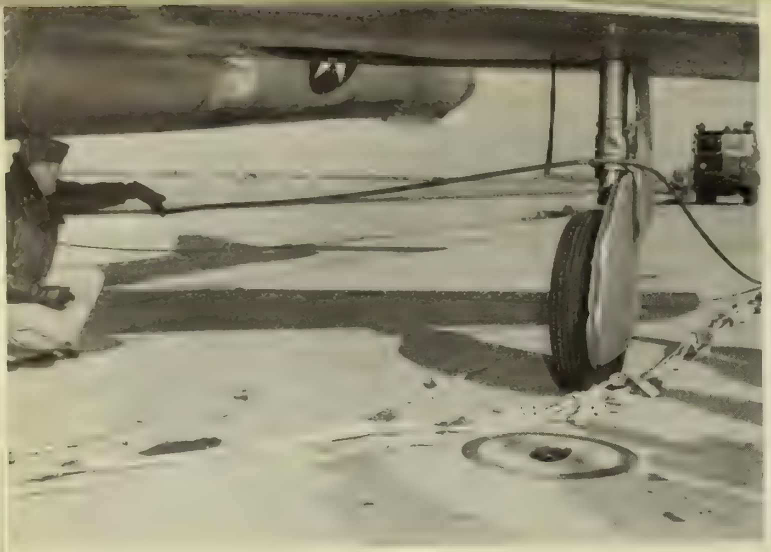
Flight Service Centers, like any base operations section, will be especially busy at certain times of the day and certain days of the week. Personnel can be scheduled to meet these added requirements, but mechanical facilities must be programmed to give adequate service commensurate with cost. Facilities such as communications equipment must be programmed well in advance, with the need definitely established, and cannot be economically cut off and on for short periods.

Flight Service interphone lines are leased from the American Telephone and Telegraph Company whose technicians recently completed an extensive and detailed traffic analysis of the entire system. Recommendations for immediate circuit realignment based on the best customer service for the dollar have been accepted and will be in effect for the busy summer period. Further analysis is being made of the data collected with the goal of developing the ultimate in an operations communications system.

One of the hardest places to prevent delay in a Flight Service Center is at the weather forecasting positions. This is certainly no reflection on the capabilities of these technicians. Flight in modern high performance aircraft requires more extensive weather information for briefings and naturally this takes more forecaster time to prepare and deliver. For instance, takeoff roll must be computed for each USAF jet aircraft departure. Since this is determined by pressure altitude and temperature, these elements have to be forecast for ETD and included in briefings. Forecasters who work in a Flight Service Center are restricted much of the time to the immediate vicinity of their desks where the interphones and telephones are located. Current forecasting tools are brought to them and they are under almost constant pressure during busy hours.

What is being done to speed you on your way so that you aren't flying on the end of a telephone? Flight Service is expanding its facilities and personnel structure. Air Weather Service is adding forecasters during especially busy periods and is streamlining its operations in the Flight Service Centers. But you too, can be a big help in speeding things up. When you request a weather briefing the forecaster must know your proposed route of flight, altitude, estimated time of departure and estimated time en route. It takes a forecaster longer to develop a briefing than it does to give it, so state what you want to know in as much detail as necessary. A call back to get additional information takes both the forecaster's time and the interphone line time. The proper sequence and information required when filing a flight plan with Flight Service is in the Facility Chart.

The most logical time for pilots to get a clear picture of the weather situation as well as operational information is when he is on the ground with ready access to this information. Flight Service exists for but one purpose, that of providing the best possible service to the military pilot for the safe completion of his flight, regardless of conditions. So, take your time, plan a good flight and fly a good plan. ●

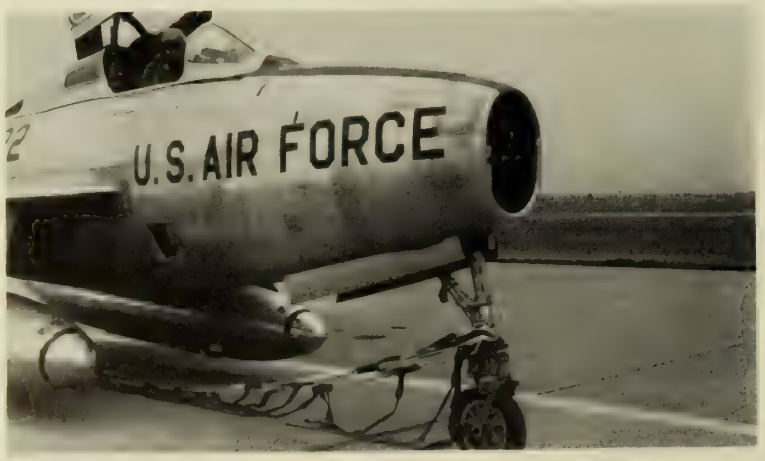


Proper engagement results in only minor damage to this F-84F gear faring.

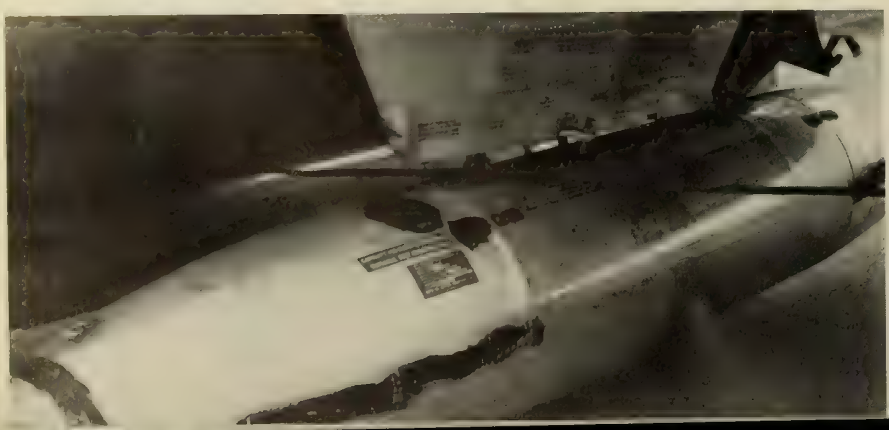
The information in this article is based on the latest barrier test data compiled by WADC.

Big League Catcher

Test at 30 mph with 450-gallon tanks resulted in unsuccessful engagement.



Test at 45 mph resulted in the cable overriding 450-gallon tanks on F-84F.



LET'S TAKE AN imaginary fighter jockey, buckle him into a hypothetical jet fighter and stick him smack-dab in the center of a thoroughly unpleasant situation. We'll have him charging down the runway at full bore, reaching takeoff speed and then losing his power. One minute everything was going fine and the next our hero finds himself in sort of a tough spot since he is traveling too fast to get stopped before running fresh out of strip.

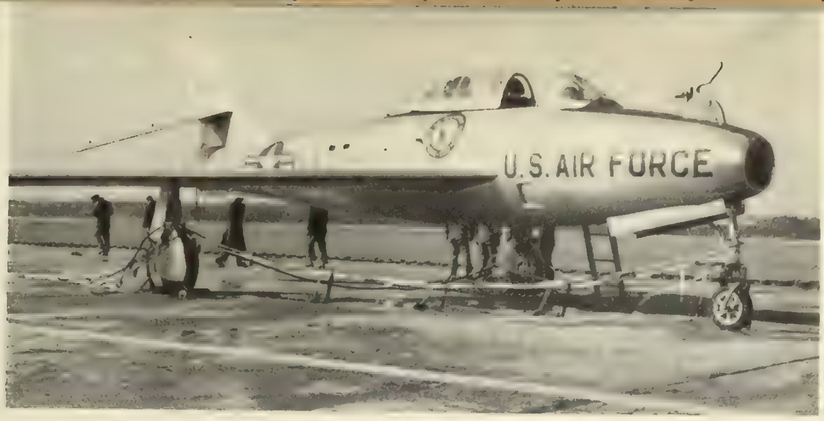
We seem to have things arranged so that this boy has hardships he can't possibly use. But wait a minute, maybe they aren't as rough as they seemed at first glance. At the far end of the strip, awaiting our guy's onslaught, is a large nylon net, or runway barrier. And this barrier was designed specifically to do the job of catching jets that otherwise would run off into the boondocks.

Okay, so all this boy has to do is guide the fighter into the center of the net and come to a screeching halt. A little gear fairing may get torn up but that should be about all. Let's follow the engagement.

The airplane's nosewheel hits the nylon straps, the cable raises up . . . and plane, pilot and all go right on through, roll off the overrun and end up in a ditch. Our fictional pilot scrambles out uninjured, but you can scrub one jet aircraft.

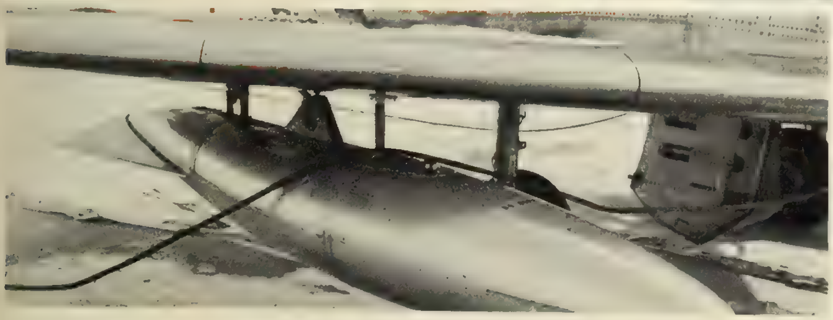
But what happened; why didn't this imaginary incident end happily for all concerned? Remember, we said that this was a hypothetical case? We didn't say what kind of a fighter our pilot was flying. If it was a T-33, an F-80, an F-94 or any F-84A through G, he might have forgotten to retract the speed brakes. If it was an F-86 with 200-gallon pylons, an F-94C with 250-gallon pylons or an F-100A with 450-gallon pylons, perhaps he failed to jettison the tanks prior to hitting the barrier. One thing is fairly certain; when he failed to get a successful engagement of the barrier, it was because of lack of knowledge. That is, our imaginary pilot didn't know exactly what to do to insure a safe catch.

Recently, WADC completed a series of tests on barrier catches and came up with some interesting recommendations and information on operating characteristics and installation changes. This data will be incorporated into revisions of T. O. 35E8-2-2-1 but the sooner it is disseminated to the field, the better.



Above, in a clean configuration, this F-84F hits the barrier successfully at 150 mph. Left, another successful stop with 450-gallon inboard pylons. Engagement at 98 mph.

Below, with 120-gallon pylon tanks, the minimum engagement speed was 45-50 mph.



Side view of the F-86A shows how arresting cable overrode 120-gallon pylons at 50 mph.

Below, in the clean configuration, barrier can be engaged as low as 20 mph in F-86A.

Before getting into the meat of the information there is one important point that should be emphasized. While WADC recommends that certain aircraft retain their pylons during barrier engagement because it presents less of a hazard than dropping them on the runway, this doesn't mean that pylons can't be dropped. It is recommended that in any case where an emergency occurs in flight and the possibility exists that a barrier will be used, that external stores be jettisoned before landing. In all fighter aircraft, there will be a higher degree of reliability during engagement when they are in a clean configuration. So, if it looks as if you will need to use the barrier, get rid of those stores before landing.

Operations and installations people will be interested in how the barrier equipment fared during the tests.

In over 50 engagements made during the tests conducted by WADC, using the standard webbing adapter 54H22130, there was no case in which the webbing adapter failed to function properly. This adapter was tested at speeds as high as 160 mph. The arresting cable installation was made in accordance with T. O. 35E8-2-2-1 to insure proper slack condition. Operations people should be sure that the installation personnel at their base are thoroughly familiar with the T. O., as you can run into

Aircraft Model	Inboard or Mid-wing Pylons	Dive Brakes	Napalm, Rockets Other Stores	
T-33	N/A	Must be Retracted	N/A	
F-80	N/A	Must be Retracted	N/A	
F-86 A thru D	Retain 120 Gal. Tanks	N/A	N/D	Minimum engagement speed 45 to 50 kts.
	Jettison 200 Gal. Tanks			
F-94 C	Jettison 250 Gal. Tanks	Must be Retracted	N/D	
F-84 A thru G	Retain 230 Gal. Tanks	Must be Retracted	*	Minimum engagement speed 40 kts.
F-84 F **	Retain 230 Gal. Tanks	N/A	N/D	Minimum engagement speed 40 kts.
	Retain 450 Gal. Tanks			Minimum engagement speed 35 to 40 kts.
F-100 A	Jettison 450 Gal. Tanks	N/A	N/D	

* Successful engagements at minimum speed of 35 knots have been made with inboard pylon 1000 pound bombs attached.

**230-Gal. outboard or underwing tank should be retained.

N/A — Not applicable. N/D — No Data available.

The chart shows engagement limitations for the runway barrier by aircraft type.

serious trouble if the cable is not installed correctly.

Another important point for operations supervisors to check is the revised arresting chain. The Center recommends that the chain be composed of five connected sections or "shots" totaling about 450 feet. The first "shot" is composed of single links of chain, each weighing from 45 to 55 pounds per lineal foot. The other four "shots" are double links that should weigh from 100 to 120 pounds per lineal foot. As an added margin of safety, a new arresting cable has been designated to replace those now in use. This cable, which is 7/8" wire rope and stronger than the old cable, should be requisitioned and installed as soon as possible. The stronger cable and increase in quantity of chain were made to provide for high speed engagements at higher gross weights which will become necessary for new aircraft.

The tests run by WADC resulted in quite a few recommendations for various airplane models. In some cases, additional recommendations were made as a result of experience with similar models although actual tests weren't run.

The tests revealed that the F-86A through D, in a clean configuration, could engage the barrier successfully at speeds as low as 20 mph. However, with 120-gallon pylons on, the minimum engagement speed was between 45 and 50 mph. No tests were run with 200-gallon pylons installed on the F-86 but other test data on large pylon tanks decided WADC to recommend jettisoning the 200-gallon pylons.

On the T-33 and the F-80, minimum engagement was made at 20 mph, and tiptanks may be retained as they present no problem on a catch. However, be sure the speed brakes are retracted as they will force the cable under the main gear.

Minimum engagement speed on the F-94 was 30 mph, and, although tiptanks should be retained, it is recommended that if the aircraft has 250-gallon mid-wing pylon tanks installed, that they be jettisoned. Once again, speed brakes-in.

Tests on the F-84 models A through G revealed that in a clean configuration, minimum engagement speed was 35 mph. Both tiptanks and the 230-gallon mid-wing pylons may be retained, but minimum engagement speed for aircraft equipped with pylon tanks is 40 mph. With inboard pylon 1000-pound bombs attached, minimum speed was 35 mph. Speed brakes must be retracted.

Minimum engagement speed on the F-84F in a clean configuration was 35 to 40 mph. With inboard pylon tanks of 230-gallon capacity, minimum speed was 40 mph; with 450-gallon tanks, minimum speed was between 35 to 40 mph. With 230 gallon outboard underwing tanks the minimum speed was 40 mph.

To date the F-100 has not been tested, however, based on the geometry of the landing gear, it can be assumed that engagement in a clean configuration will be successful. WADC recommends that mid-wing pylons be jettisoned prior to engagement. At present, there is no data available on the F-89, 101 or 102.

The information listed in this article is scheduled for inclusion in each aircraft's Flight Handbook; but until a pilot receives it, check what we have here and be sure you know what to do before you have to use a landing barrier. If you wait until you're rolling down the runway toward it, it's going to be a little late.

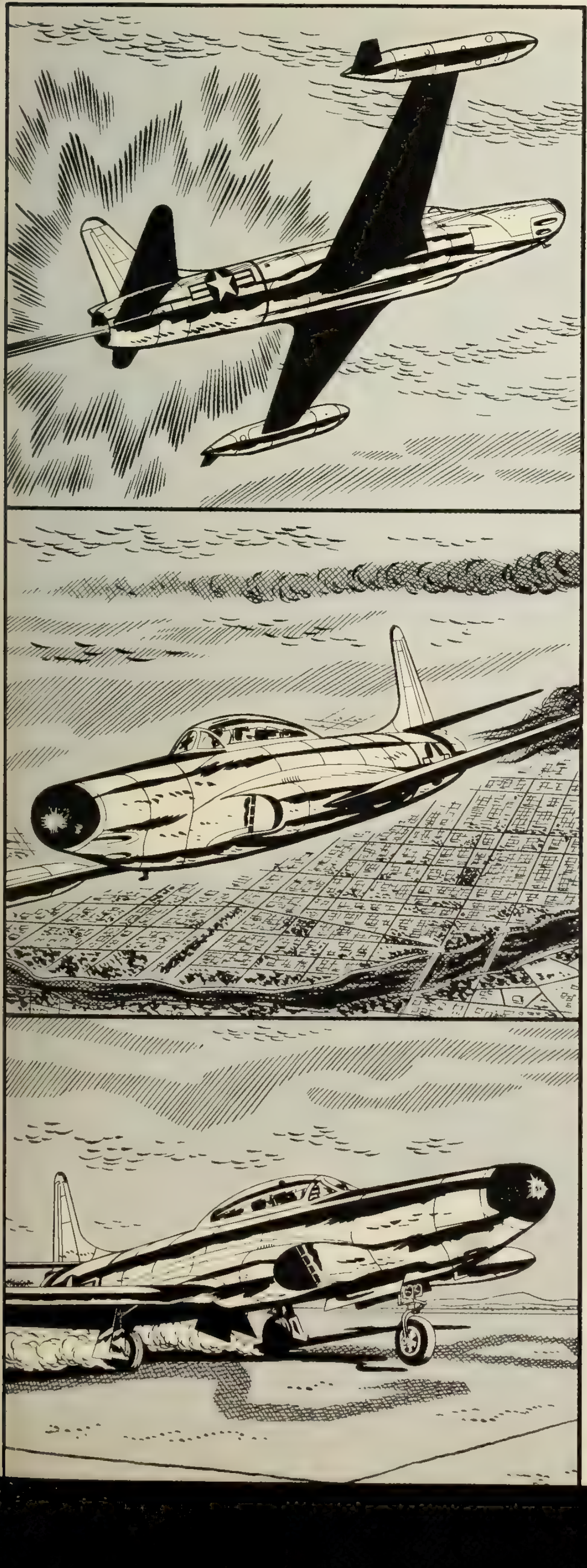
There are several other important procedures that a pilot needs to know to insure a successful engagement.

- Hit the center of the net.
- Brake the plane normally but don't clamp down on the binders so hard that you blow a tire. As you near the barrier use the brakes to steer toward the center of the net. ●

Col. R. B. Spear

134th F-I Sq. (ANG)

WELL DONE



IMMEDIATELY after takeoff in a specially modified F-94A, Colonel Spear heard a loud explosion just as he was turning off the after-burner. This was followed by an instantaneous power loss, although all engine instruments were giving normal indications. Both the tail section overheat warning light and the plenum chamber fire warning light came on and he noted that smoke was trailing behind the aircraft.

A 120-degree turn back toward the base was made immediately, thereby establishing a downwind leg for the one available runway. He was now at 2000 feet, aircraft apparently on fire, no thrust available and over a densely populated area. It was now or never.

His first thought was an immediate ejection, but he abandoned the idea after a quick glance at the city below. Colonel Spear realized too that he would have to keep the nearly full 230-gallon tiptanks. Jettisoning them would surely result in civilian casualties.

He quickly decided to attempt a landing on the crosswind runway, even though the final approach would have to be made over a deep gulley immediately off the end of the runway. ILAS equipment protruded into the glidepath, making this approach additionally hazardous.

Touchdown was made on the numbers at minimum speed for the load, with not a foot of altitude to spare. Prompt action by the crash crew extinguished the fire and damage to the aircraft was minimized. Few, if any, of the thousands of people below know that one man's skill prevented a tragic accident.

To Colonel Spear a sincere WELL DONE.

the LOW DOWN on HIGH UP

Capt. Gerald M. Breen, Hqs, Air Weather Service

DURING RECENT years, attention has been focused on the structure of the higher atmosphere, particularly in connection with problems posed by developments in new types of high-flying aircraft, rockets and missiles. Many agencies are currently extending our knowledge and contributing greatly to the scientific fund of research in order to explain climatic processes. The applied climatologist must analyze and interpret many climatic factors that enter into problems of design, specification, planning, location and operations.

In connection with the upper troposphere and lower stratosphere, roughly at heights above 10 miles, the climatologist is often asked: "Where do you get your information? Upon what are the records based? How do you know that such a phenomenon occurs at this height?" Suppose we answer these questions by taking an imaginary trip up through the atmosphere; with a self-imposed ceiling for this ascent being placed at about 40 miles.

Research into the upper atmosphere has moved fast since World War II. Scientists using high altitude rockets have made remarkable progress. Unexpected associations, some still unexplained, have been found to exist between physical conditions in the upper atmosphere and weather conditions in the tropospheric region. The lower atmosphere or troposphere exists between ground level and the tropopause, which is the boundary or zone of transition between troposphere and stratosphere. The troposphere varies in height, depending on the latitude, from about four miles at high latitudes to 11 miles at the Equator.

The stratosphere designates the atmospheric region lying between the tropopause and an upper boundary known as the stratopause. During the ascent on our imaginary flight after reaching the stratopause level, the temperature first begins to increase at a more rapid rate than is characteristic of the lower stratosphere. The level of the stratopause varies between 22 and 31 miles, according to the latitude and time of year.

Unmanned balloons can function at great altitudes, up to 25 miles if carrying only very light instruments, but presently they reach a level where the surrounding air is of about the same density as the hydrogen in the envelope, and so they lose their buoyancy.

Rocket and guided missile research, as well as high altitude aircraft, provide valuable experimental techniques. The first man to enter the stratosphere for certain, and to survive, was the Swiss physicist, Piccard, who ascended to 10 miles in 1931.The last great ascent was by the American helium-filled Explorer II in 1938 where a record height of 14 miles was reached. The greatest height yet reached by an unmanned rocket is reported to be 250 miles.

Of the four principal types of atmospheric soundings — rockets, acoustics, searchlights and radiosondes — only the latter have furnished sufficient information for adequate quantitative analysis. Where radiosonde data are scarce, acoustical soundings have proved valuable.

As we ascend from the earth's surface the pressure and density of the air fall steadily. At 10 miles, near the base of the stratosphere, the atmospheric density is about 1/10 of that at sea level. Atmospheric tenuity does not merely affect men but also machines. Aircraft require the atmosphere for support. There is a limit to the height at which reciprocating engine aircraft can even operate. That limit is between 10 and 15 miles or, roughly speaking, where the air pressure is about 1/20 of its sea-level value. Fortunately our rocket-powered craft is not so affected and we continue on.

Stratosphere Clouds

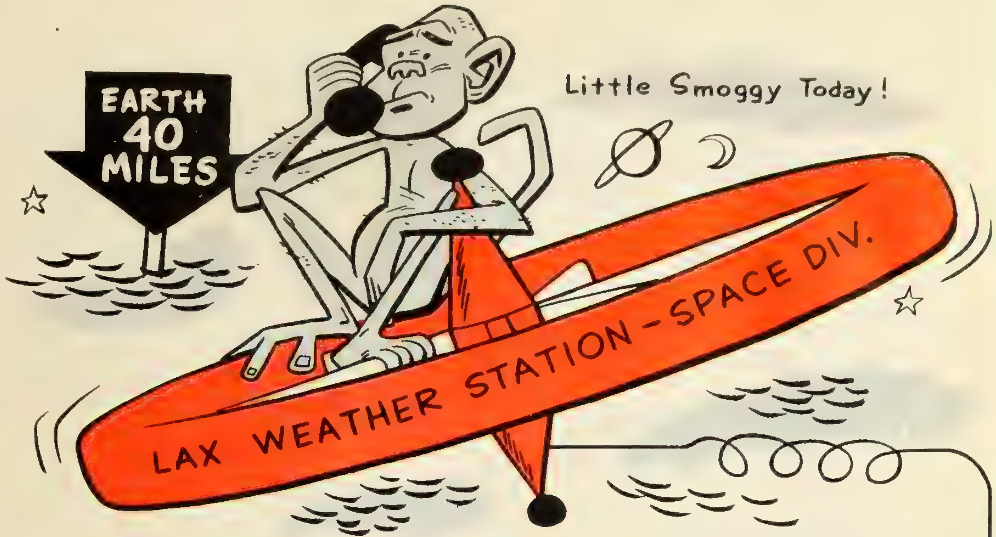
As we journey into the upper atmosphere, some stratospheric clouds are observed. These mother-of-pearl or nacreous clouds, as they are called, generally appear at the 14 to 19-mile level. This seems to indicate a region of cooling at the top of the stratosphere. By analogy with clouds in the troposphere, it is usually assumed that they consist of water droplets or ice particles. The total range of cloud height is remarkably small, being little more than twice the average thickness of the clouds, between 1.2 and 1.9 miles.

Temperature Structure

The temperature distribution in the troposphere and the lower stratospheric regions is now well known from direct observations with the help of sounding balloons and smoke shells. The accompanying chart shows the average temperature structure of the atmosphere in temperature latitudes up to 40 miles, together with the sources of information for various height ranges. Available values for upper atmosphere temperatures are derived from a study of radiosonde data, the absorption of solar radiation by ozone, irregularities in the propagation of sound, luminosity and speed of meteors, atmospheric tides, the auroral spectrum and the reflections by radio.

In recent years the vertical temperature structure up to 12 miles has been extensively explored by radiosonde. Since World War II, soundings up to 19 miles have been experienced very frequently.

Starting with an average surface temperature of 20°C., the atmosphere becomes colder with increasing altitude until in the region which divides the troposphere and the stratosphere a temperature of


EARTH 40 MILES
Little Smoggy Today!
LAX WEATHER STATION - SPACE DIV.

How do you fellows get your information?

—55°C. is found. As the ascent continues through the stratosphere, the temperature remains nearly constant until at a height of above 19 miles where it starts to increase and reaches a maximum of over 85°C. at about 36 miles.

Research has shown that there is a definite increase of temperature with height between 19 and 36 miles, with maximum temperatures approximately equal to those at ground level. The rise in the middle atmosphere between 20 and 34 miles is caused by absorption of solar radiation by ozone. Observations on the abnormal propagation of sound waves and study of the heights of appearance and disappearance of meteor flashes confirm this.

Weather balloons such as the "Moby Dick" are used to provide altitude weather information.

A small amount of ozone, spread in a very diffuse layer between 12 and 31 miles above the surface of the earth and with its maximum concentration at about 16 miles, protects life on the earth from extinction by solar ultraviolet radiation. Ozone becomes warmer when solar ultraviolet radiation is absorbed; in fact, the ozone layer acts somewhat like an enormous heat reservoir accounting for the temperature maximum at a height of about 36 miles.

Stratospheric Turbulence

Aircraft flying in the stratosphere sometimes encounter localized patches of "bumpiness." The explanation of this problem is difficult. Large atmospheric eddies take a very long time to weaken. The release of potential energy and the observed turbulent energy may be well separated in space and time. Irregular wind components can be looked upon as manifestations of large-scale turbulence, which is indicated by most of the stratospheric wind observations. However, knowledge of turbulence in the stratosphere is very rudimentary at present.

Wind structure and temperature of the atmosphere are clearly associated. In particular, the effect of mixing upon the composition of the air can appreciably influence atmospheric-temperature-pressure relationships. Although we ride through a bit of clear air turbulence in our imaginary ship, we're still in the dark as far as a solid, conclusive explanation goes.

North America Winds

Wind systems in the upper atmosphere are complicated and variable. Various techniques are used to study winds, such as high-altitude balloons, smoke shells, compressional wave propagation and distortions of meteor trails. At levels above 19 miles, the following methods provide valuable information: Sound propagation, persistent meteor trails, noctilucent clouds, smoke and vapor trails from V-2 rockets, movement of ionized clouds and theoretical work on atmospheric oscillations and various magnetic disturbances.

While graphical summaries give some indication of the North American circulation pattern, caution should be used in reading such charts since deficiencies inherent in some techniques and the distribution of data may cast doubt upon the accuracy obtained.

Above 10 miles, the chart shows a distinct monsoonal effect over North America, with a strong reversal of direction from summer to winter. Winds are predominantly from the east during summer and from the west during the winter months.

Generally an increase in windspeed can be expected with altitude until the stratosphere is entered, at which point velocities will decrease. At a height of about 12 miles, another increase will occur and average windspeeds of about 130 knots can be expected. During winter, windspeeds increase with increasing latitude, while during the summer they decrease with increasing latitude.

As was previously mentioned, the boundary between the troposphere and stratosphere is called the tropopause. It is an approximately level surface which has discontinuities or interruptions in the belts of strongest winds, called jet streams.

Jet streams appear as tongues or narrow bands of high-speed westerlies; they are meandering belts or "rivers" of fast moving winds passing between much slower winds on both sides. These belts are most intense at elevations of six to seven miles (30,000 to 35,000 feet). Mean charts show jet streams with speeds of about 100 knots circling the globe between 20 degrees and 30 degrees N. latitude in winter; in summer, a speed of about 50 knots is found between 35 degrees and 50 degrees N. latitude. This concentrated high wind system has been studied in detail by researchers at the University of Chicago, who coined the descriptive term "jet stream."

Even a brief description of the complexity of the atmosphere serves to emphasize the need for an abundance of accurate data before a much fuller understanding can be gained. An ideal opportunity for more intensive study of high-altitude winds, for example, is provided by establishing certain years for international cooperation and effort.

Well, this little excursion into the upper regions was over almost before it started and there wasn't a great deal to see. But one of these days we'll get out of the imaginary rocket class and into reality. Then our knowhow will increase by leaps and bounds. ●

chilled and Chattering

RECENTLY, WE heard of a young fighter pilot who had one of the more positive statements of the year to make after a rather hairy experience. Seems as if he was quoted as saying, "I'll carry a dinghy when I'm crossing the Mojave Desert. I don't care where I am flying, I'm going to have one aboard, believe me."

Now it isn't too hard to think of quite a few places where a dinghy is just excess baggage; but maybe this lad had a point, at that. Plenty of USAF pilots make flights everyday that just possibly could end up over a large body of water. And if a man suddenly had an emergency occur about then, a dinghy would come in real handy.

The author of the above statement furnishes a case in point. His accident had several points of interest; it involved not only a survival problem but also a serious malfunction in the rocket-firing system of his fighter aircraft. In his own words, here is what happened.

"I was lead ship in a flight of two fighters participating in a rocket familiarization ride over Lake Huron. The accident occurred when I lost control of the aircraft as a result of a fire and had to bail out.

"We were briefed on the armament and firing portion of the flight, and on the flying phases as well. The briefings were supervised and no discrepancies were noted.

"After starting the aircraft, we took off and climbed to 5000 feet and proceeded to the range. On the way out we contacted GCI and requested them to track us so we would be sure that we were over the range. Shortly afterward, they confirmed our position as being over the southern portion of the rocket range.

"We then dropped down to about 1300 feet indicated to clear the area and make sure that there were no boats on the range. After we had picked out a good spot, we pulled up and started flying a box pattern to the left. I told the wingman that I would make the first dry run. We pushed over from 4000 feet, at 85 per cent rpm and about 280 knots, and simulated rocket firing at 2000 feet indicated. I then pulled up to 4000 feet, safetied all switches and started another left hand pattern.

"As we turned onto final, I picked out a slick spot on the water to fire at and proceeded to set up the aircraft for the firing run. Screens were extended, switches placed in firing position, with the switch on 'fire 12' and manual position, and all circuit breakers in. I pushed over again, this time at 90 per cent rpm, and at 2000 feet I squeezed the trigger and felt the pod drop and heard the hissing of rockets, but nothing came out.

"My wingman informed me immediately that I had hung rockets which were burning and advised me to get rid of the pod at once. I moved the armament master switch to the emergency jettison position but the pod didn't drop and my wingman called again, telling me to get rid of everything. I then rotated the switch to the jettison ready position and hit the 'panic button'. (This dropped the tips; I should have depressed the salvo button on the stick but things were getting a little tight at this point.)

"As I hit the switch the airplane started to roll to the right and I grabbed the stick and moved it full left. This had no effect on the roll, so I immediately ejected.

"I forgot to pull my visor down and the wind tore my helmet off right away. I tumbled about three times and the wind threw my arms back, but finally I got them around and grabbed the seat belt. The seat left as soon as I hit the belt and after a few seconds I pulled the D ring and opened the chute.

"As soon as I got straightened out in the chute I took inventory — my oxygen hose was still strapped to the chute; I took it off and threw it away. I repositioned the dye marker to where I could get hold of it easier and got set to hit.

"I pulled on my risers as I hit and went under about five feet. I was partially entangled in the shroud lines but I got my knife out and started cutting through the lines. As I was cutting, I noticed that my hands were getting quite cold. I inflated my Mae West and slipped out of the chute harness. Then I spread some dye marker and just waited.

"I held my hands under my chin, gripping the Mae West, but it felt as if the circulation was stopped. I tried sticking my hands in my mouth to warm them. It didn't work. My G suit seemed to help keep circulation going in my legs and my jump boots helped for my feet.

"About 15 minutes after bailout I had lost all feeling in my body and between 25 and 30 minutes after I got out I started shivering uncontrollably and then passed out. I didn't remember anything else until I woke up in the hospital."

This pilot bailed out over one of the Great Lakes near the end of the month of March. The lake was covered by a thin layer of scum ice, and the water was at least 0°C. His statement concerning the need for a dinghy is now obvious. Fortunately for him he was pulled out of the water shortly after he lost consciousness and suffered no after-effects.

His wingman and another wide-awake pilot alternated in buzzing the shore until they were able to raise some boats from shore and direct them to the downed pilot. He was in the water approximately 50 minutes and during this period was unconscious for 20 minutes. His body temperature upon recovery was far below normal, and it is doubtful if he could have survived for much longer.

No wonder this lad is determined to carry a dinghy wherever he goes. He may not need it over the Mojave, but if the occasion arises, he is going to be prepared, just in case. How about you? ●

REX SAYS

It HELPS TO be strong in this man's Air Force. At least, one of our jet jockeys saved an aircraft for Uncle Sugar by the strength of his good right arm, to say nothing of saving himself.

The pilot in question took off in No. 4 position in a flight of four F-86s. After breaking ground, he placed the gear and flap handles in the UP position. Immediately, he noticed a severe rolling tendency to the left which required full aileron trim to keep the plane upright.

As the airspeed increased, the tendency to roll increased also. By reducing power, holding strong right stick pressure and with full trim in the pilot was able to keep the aircraft under control.

A quick check of the aircraft revealed that the left flap was up and the right flap was full down. He called the flight leader who joined him and confirmed that one flap was down. After gaining a safe altitude, the flap handle was moved back and forth several times, but no flap reaction could be obtained.

The pilot notified the tower that he would remain airborne to use up fuel and lighten the load. By experimentation he found that with the speed brakes out and with the gear down and locked he had better control of the aircraft which stalled at around 143 knots.

He flew around at 150 knots, burning up fuel, and flying with his left hand in anticipation of the strength that would be required on his long, final approach.

He tooled around in a wide pattern, got her turned onto a long, final approach and, with a little sweat and much elbow grease brought it in for a successful landing. We feel this boy showed plenty of good flying ability and more than average level-headed planning to get the plane in with no damage.

REX SAYS: *I certainly concur in that last statement. Your boy did an exceptional job in a tough situation. He deserves plenty of cheers from all of us.*

★

I TOOK OFF the other day in a B-26 with a crew chief for company and after an uneventful climb to 5000 feet, advised airways that I was going to do a bit of range work for an hour. It was a perfectly clear day so before getting under the hood I told my passenger to keep his neck on a swivel. I have a certain aversion to running into solid things like mountains or other aircraft.

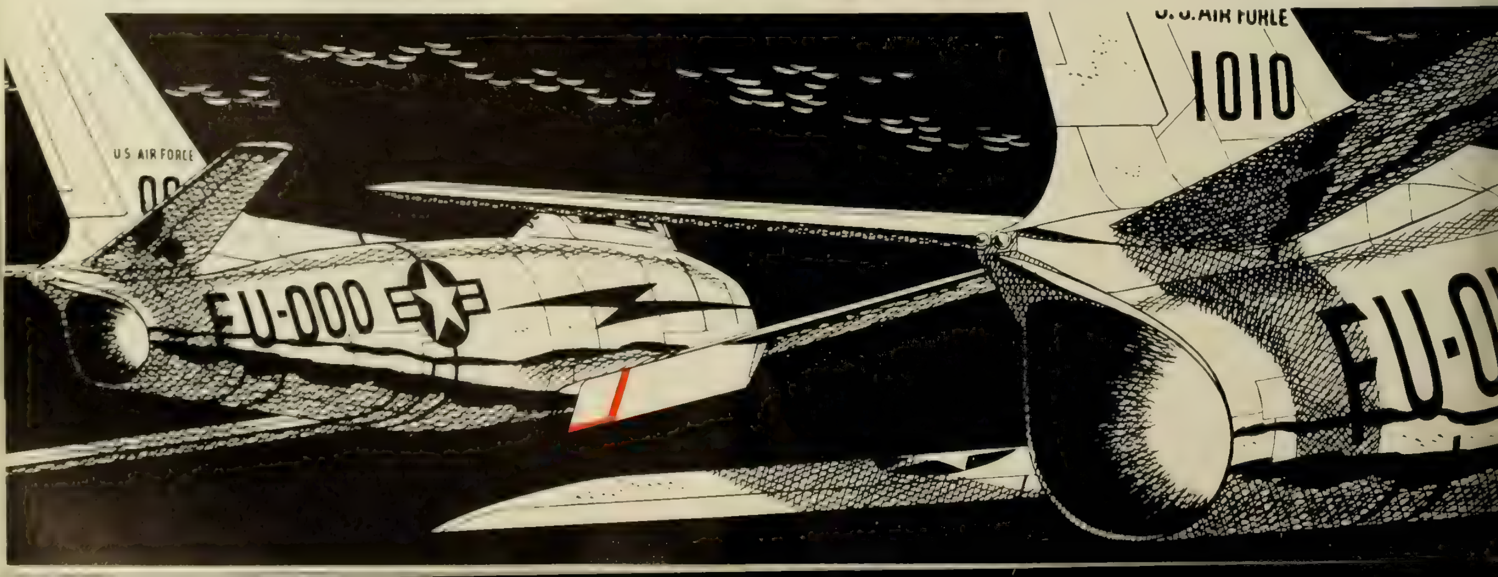
I became quite interested in A's and N's, and odds and ends in the cockpit like needle and ball, airspeed and the horizon. In fact, I became so interested that about 30 minutes had passed before I happened to glance at my "safety pilot." Apparently my gentle flying and the warm rays of the sun had lulled him deep into the arms of Morpheus. To wit, the clobber-head was fast asleep. Unfortunately this shook me up so badly I couldn't concentrate on the gages, so I called off the whole thing before we both made it a really long, permanent sleep.

REX SAYS: *As the Good Book says in the 23rd Psalm, "Thou art with me." AFR 60-4 calls for a "qualified observer." This sleeping beauty could hardly qualify. Amen.*

★

IT IS ALL well and good to observe the limitations as to minimum altitudes and airspeed, especially in single engine operation of a twin-engined aircraft, but circumstances certainly do alter cases. Possibly I have had more aversion than most to flying over metropolitan areas, characterized by solidly built structures, having done most of my flying in the wide open spaces.

A quick check by the wingman revealed that the left flap was up and the right one, full down.



The lightning strike was accompanied by a loud artillery-like explosion.

Just a few months before my pending retirement, after 35 years in the Air Force, I was taking off from a base in a nice, plush, Cocoa four seven, to return to my duty station. Both engines checked out perfectly, and the takeoff was routine until the aircraft was about 15 or 20 feet in the air and well committed to flight. Suddenly I had the startling realization that the aircraft wanted to slow-roll to the left. It felt as though the left engine had suddenly given up the ghost and quit.

I had a couple of hands full of airplane while trying to pick up that left wing. My trusty copilot manipulated the throttle controls and obtained full power from the right engine, but the left propeller refused to respond to all feathering attempts. Even the prop control had no effect on the smoothly windmilling brake that had been the left fan.

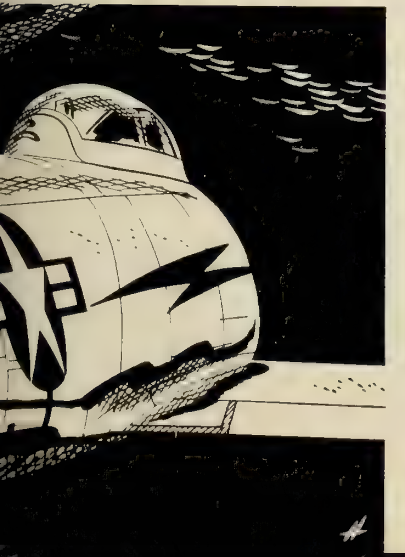
After the boundary was cleared and we had passed over the surrounding roof tops by what seemed like inches, I was able to climb to nearly 150 feet, but the last 50 were soon lost when power had to be reduced because of the high engine temperature.

I couldn't turn right because of obstructions so we started a slow left turn to get back to the field. The entire flight from then on was made at between 90 and 100 mph, dodging water towers and sundry buildings which loomed above us. We got the gear down just as we crossed the boundary and finally landed.

Strangely enough there was not a thing wrong with the engine, the prop was the villian all the time.

This was about the shortest flight I have ever been on, but I certainly did not suffer from boredom.

There were a couple of things that aided in preventing a major catastrophe. In the first place, the radio compass had been set on the local homer prior to takeoff. At the altitude we were flying it would have been impossible to locate the field without it.



Next, the copilot did a bang-up job in assuring maximum results from the right engine.

I suggest that each copilot keep a constant check on RPM during takeoff. Chances are if that prop is going to act up it will start its shenanigans before you become airborne.

REX SAYS: *Glad you made it. This little episode makes me think back to the required engine check-out recommended in the C-47. If you remember, it does not require a full power check during runup. However, it states that during the takeoff run a check of the RPM must be made to see that the governors are functioning. If they work okay then, chances are they will probably stay with you.*

★

YOU HEAR A lot about pilots getting bounced by a large jolt of lightning but mostly you don't figure it will ever happen to you. Well it can; it happened to me.

I was flying a C-47 and was in the process of executing a missed approach procedure at an Air Force base, when the plane caught a bolt of lightning right on the nose. At the time, we were climbing up through a layer of strata-cu and were encountering moderate to heavy snow, moderate turbulence and some light rime icing. Outside air temperature was about -3°C.

Apparently the charge distributed itself rather evenly over the wings and fuselage and was discharged from the static eliminators on both ailerons and the vertical stabilizer. The strike was accompanied by a very loud explosion which sounded like a heavy artillery piece being discharged outside the window. When hit, the aircraft shuddered momentarily but normal flight control response returned immediately.

After landing, a thorough inspection revealed burn damage to the outboard aileron static eliminators and damage to the low frequency radio antenna. Also, a small hole the size of a thumb tack was found in the rudder trim tab.

REX SAYS: *I don't imagine this experience was exactly pleasant, but think what it could have been. Fortunately, these lightning strike incidents are fairly infrequent or we would all need built-in grounds on the flying suit.*

Keep Current

NEWS AND VIEWS

Survival Diet — Last month, one hundred volunteer airmen participated in tests to aid in the development of improved global survival rations.

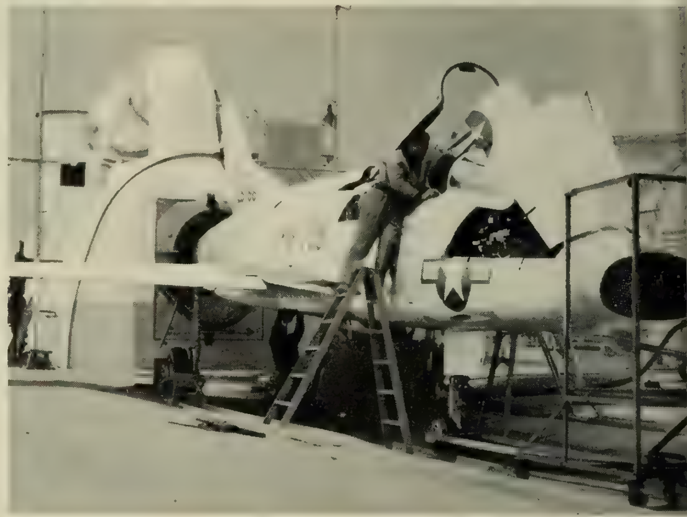
The airmen, recruited from Lackland and Chanute AFBs, subsisted on diets ranging from starvation to normal while living under field conditions.

Half the men exercised heavily, half lightly. A further breakdown in conditions was made in the drinking water given both units of men. Some were allowed unlimited amounts of water, some only controlled amounts to determine the effects of water on an airman's well being. In all, 20 different feeding situations were studied; varying in caloric content and nutrient mixture in terms of fats, proteins and carbohydrates.

The tests, made to determine the most efficient diet that will keep a downed airman alive under all circumstances, will cover a total of six weeks.

Basically, the 100 airmen were divided into four groups.

- Group I was given unlimited amounts of water, received only light exercise and was given a pre-determined ration of food daily, ranging from no food for some and up to 3000 calories for others.



This installation was devised to reduce sound during the preflight operation of the F-100. Here the tailpipe juts through opening in the silencer. The unit features a sound reducing asbestos collar.

F-89Ds are being equipped with a new fire-control device.

- Group II received the same rations of food and water as Group I but was required to exercise heavily.
- Group III received similar rations of food, exercised lightly, but was permitted only limited amounts of water.
- Group IV received food and water quantities similar to Group III, but exercised heavily.

The best method of exercise was determined to be hiking as the caloric expenditure of each individual could be controlled, and the men walked specific distances each day. In addition, the volunteers were required to shelter and care for themselves using equipment available in standard USAF survival kits.

Fire Control Help — F-89D aircraft are being fitted with a device designed to insure accurate alignment of the 104 rocket fire control system. A 28-volt electric fan directs an airflow of approximately 160 knots over the airplane's angle of attack detector probe, allowing quick calibration and alignment of the attack sensor system. The units are being shipped to all Air Force bases where the '89Ds are stationed, for installation.

Big Time Saver — Pilots using the new DME (Distance Measuring Equipment) will soon be able to make straight-in approaches to many airports instead of going through time-consuming maneuvers.

Present regulations require that a pilot make certain turns and maneuvers to ascertain his position with certainty before descending at most airports. In about 60 days, after criteria have been established and procedures published, pilots using DME will be permitted under Civil Aeronautics Administration regulations to proceed straight-in.

The saving in aircraft operating cost can be substantial. An estimate of the time saved by a straight-in approach normally is between eight and ten minutes.

This announcement was made by the Office of Aviation Safety and is a result of the high degree of accuracy demonstrated by DME. The DME provides a pilot with a direct reading of his distance from a range or an airport where the ground transmitting equipment is installed.

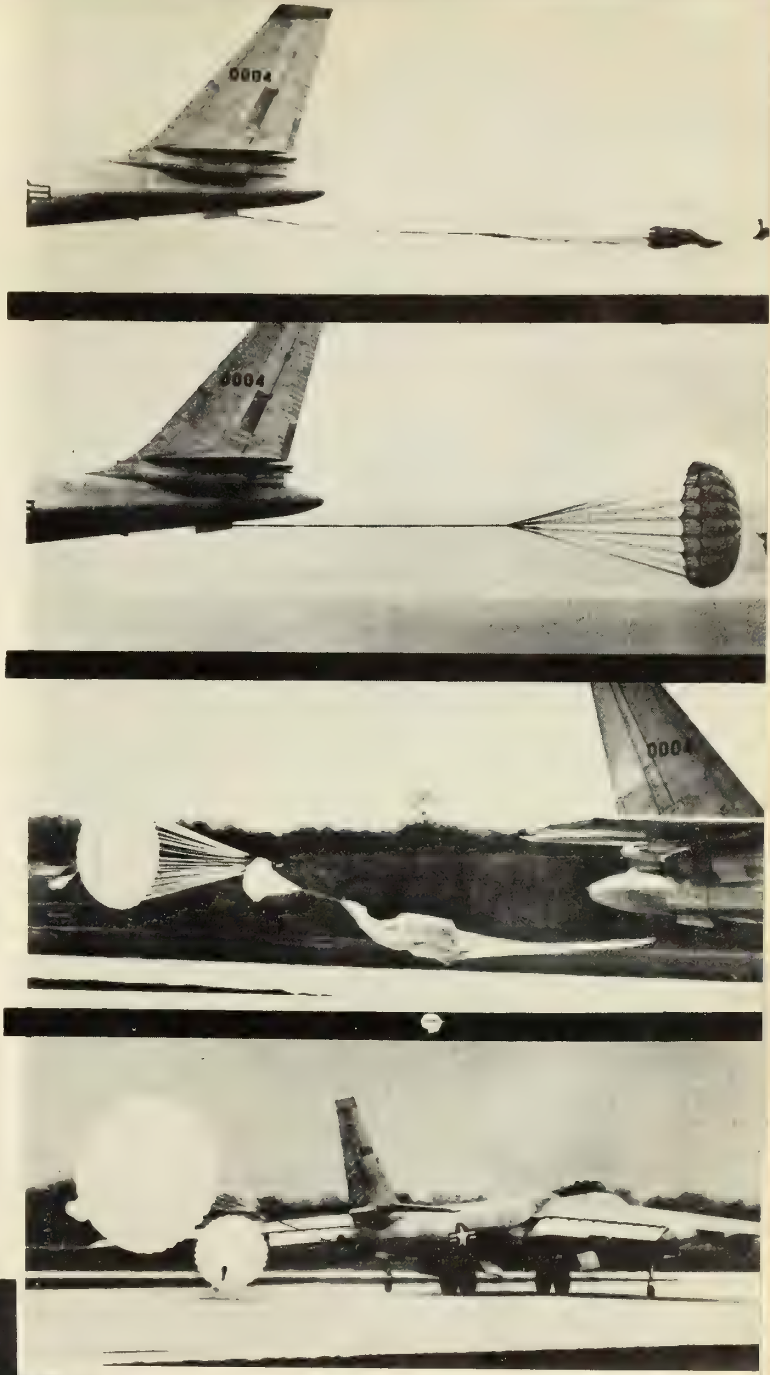
Approach Chute — The landing speed of the B-47 jet bomber has been considerably reduced through the use of an approach drag chute. Use of the chute now makes the landing roll of the B-47 comparable to that of a propeller-driven airplane of equivalent size.

The '47 has used a parachute for braking purposes for six years. The new parachute will not take the place of the 32-foot landing deceleration chute, but will be additional equipment, deployed in the air to permit a steeper descent for the landing approach.

The new parachute is approximately 16 feet in diameter and, although too large to be used as an approach chute for a fighter, it can be used as a brake parachute on the F-94, F-86, F-100, F-101 and F-102.

Using this approach control device facilitates landing on shorter runways and results in less braking action and tire wear. It also makes for better control on landing approaches and spin recovery on test aircraft.

The parachute drag device weighs approximately one-third less than other deceleration devices, thereby saving overall aircraft weight. The use of parachutes permits pilots to maintain engine power during landing, thus assuring engine response in the event of go-arounds.



The two top pictures show the deceleration approach drag parachute opening and streaming out behind the B-47. The parachute was designed for slowing down while in flight. Just before landing, the approach chute can be seen fully opened. The regular "brake" parachute starts to open and fully deploys for use in slowing down after the landing.

Left, the C-123B was recently assigned to the new transport group at Ardmore, Okla. It will perform assault-troop operations.

the Thundering Heard

Aeronautical Research Laboratory, WADC
Fred L. Daum

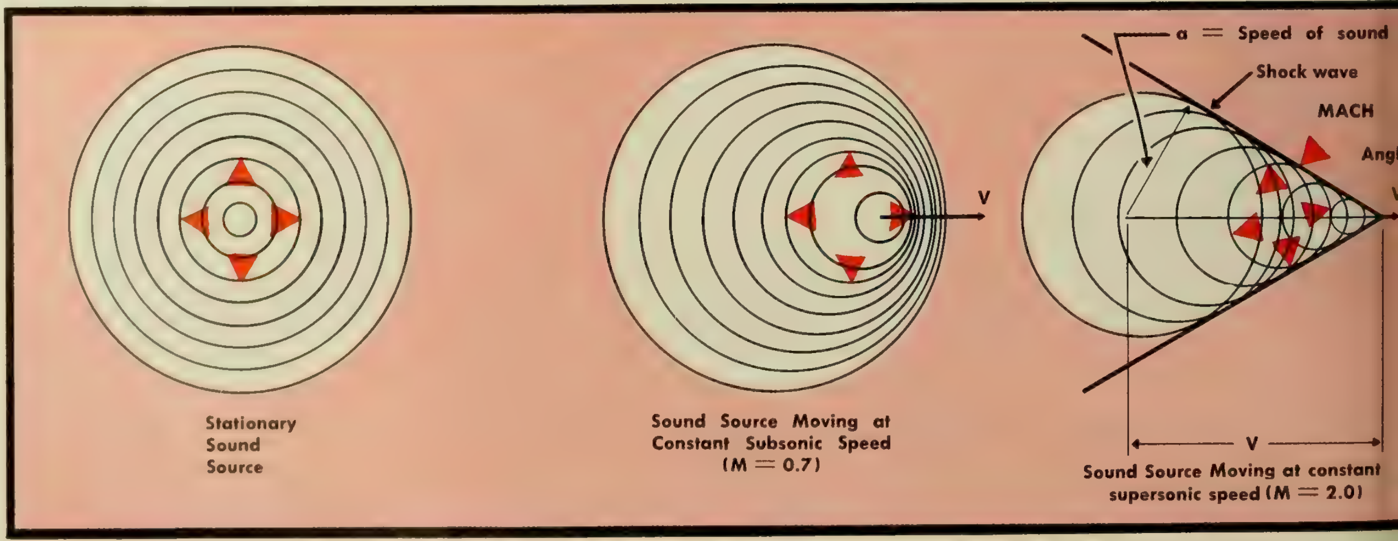
PILOTS OF NEW supersonic aircraft would do well to take a lesson from speedboaters, who quickly learn either to give other boats a wide berth when traveling at high speed or to lower their speed when passing near other boats. Speedboaters who don't learn this lesson soon find themselves unpopular among fishermen, canoeists and others whose boats they may rock or nearly upset, and sometimes find themselves on the losing side of an argument with the law.

Some pilots have found that the indignation of a few boating enthusiasts is tame indeed compared to the wrath which the shock wave from a supersonic airplane can arouse over an area of several hundred square miles. Sometimes people complain merely about a loud boom; sometimes they report broken windows or other damage to ground structures, and in one case a report even got into circulation (apparently the combined product of someone's overactive imagination plus some misunderstanding) that a boom from a diving F-86 had spread the rails of a railroad track enough to have caused derailment of a train.

This phenomenon, extensively reported in the press and by word of mouth as the "sonic boom," has been misunderstood widely and its effects greatly exaggerated, and various explanations for it have been offered. At first even the experts didn't understand it too well; now, however, as a result of investigations by the Wright Air Development Center's Aeronautical Research Laboratory and by others, the explanation seems so simple that one wonders why there was ever any mystery. Very briefly, the answer is that booms are heard whenever the shock waves generated by an airplane during supersonic flight reach someone's ears. The number of booms heard is the same as the number of shock waves reaching the person.

These shock waves are the pressure waves that are set up in the air when an airplane flies so fast that a given particle of air in front of the airplane doesn't know the airplane is

This illustration shows the propagation of disturbance.



Stationary Sound Source

Sound Source Moving at Constant Subsonic Speed (M = 0.7)

Sound Source Moving at constant supersonic speed (M = 2.0)

coming until it gets there. In subsonic flight, the airplane gives warning of its approach by very small changes in pressure that reach out ahead of the airplane and cause the particles of air to start moving aside. These warning signals are transmitted at the speed of sound. But, if the airplane is flying faster than sound, then it gets there before the warning signals and the particles of air are jostled aside so roughly that a pressure wave is set up, a cone-shaped wave in the air which in many ways resembles the v-shaped wave from the bow of a speeding boat.

Like the wave from a passing speedboat, this cone-shaped pressure wave may extend out a considerable distance in all directions from the airplane's flightpath and can be pictured as moving along with the airplane. Like the wave from the boat, it can be detected as it passes by an observer; but because it's a pressure wave in air instead of a visible wave on the surface of the water, the means by which we observe its passing is different. The main sensing element with which a human being detects pressure waves is the ear — in other words, pressure waves are simply sound waves, which we can hear if they're within the audible frequency range. A single very rapid change in pressure is heard by the ear as a boom, and this is what happens as a shock wave goes by. The shock waves generally heard are bow and tail waves, that is, the waves from the front and rear ends of the body, and these give two booms. In some areas the booms have been dubbed the "Double Whammy" because of this characteristic. Straight and level supersonic flight will give the "Double Whammy" and a supersonic dive starting from subsonic speed will give at least two, generally three, and sometimes four booms. However, the first two, about a tenth of a second apart, are usually much louder than the later ones, which apparently result from a transonic shock wave which drops behind the airplane as it goes through Mach 1.

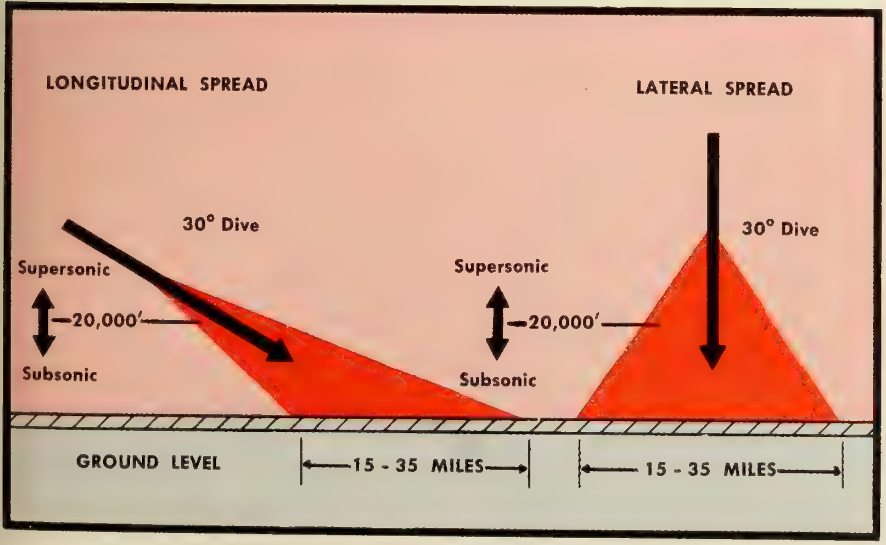
Under some flight and atmospheric conditions these shock waves may be so weak when they reach the ground that they are not heard at all. On the other hand, if an F-100 makes a supersonic pass 200 feet off the deck, an observer on the ground just below will experience a pressure jump of about a quarter of a pound per square inch.

Such sudden pressure jumps are more than enough to break windows, as has been demonstrated many times. Complaints aren't confined to broken windows, damaged structures, and interrupted sleep either. Farmers have reported that chickens, frightened by booms, panic and smother each other; cows refuse to give milk, and mink kill their young.

Sonic booms may be created in straight and level flight or in a dive. In the straight and level case, the shock waves and the airplane move through the air together, as a system, and the waves extend from the airplane to the ground. Here, a continuous trail of booms is left on the ground below the airplane's flightpath. This is something like what happens when a boat runs parallel to the shoreline, with the waves extending to the beach where they make a continuous splash as they move along the beach.

However, this simple situation isn't what has caused most of the booms. Most of them have been associated with high altitude steep dives in which supersonic speed was achieved for only a few seconds. During this short period of super-

Rough experimental observation of spread of sonic boom.

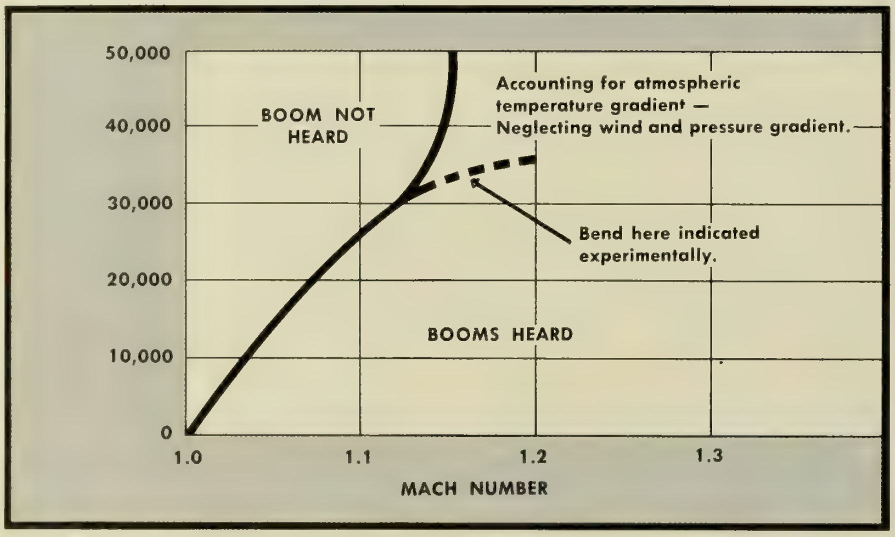


sonic flight, shock waves are formed, but as the airplane slows to subsonic speed these waves continue on ahead of the airplane until they reach the ground and are heard as booms. If we return again to our boat analogy, it's as if the boat were headed toward the beach at high speed and then either slowed up or turned around. The waves already formed would continue on, growing weaker all the time, but would still hit the beach.

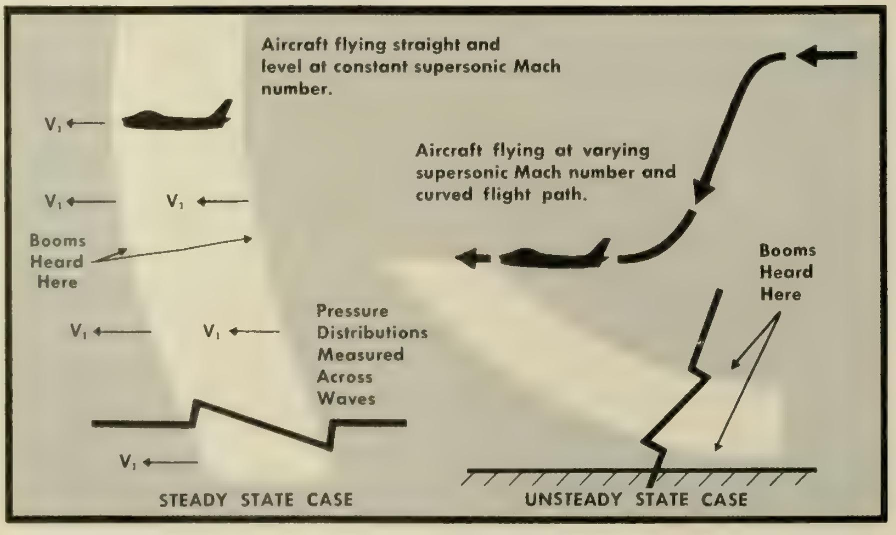
In theory, a pilot can deliberately boom a given area on the ground by diving toward that area at supersonic speed then slowing to subsonic speed and pulling out. Actually, the pilot can't be quite sure where the boom will hit because of temperature, pressure and wind gradients in the atmosphere. In a standard atmosphere and with the same wind at all altitudes, the boom will generally be loudest somewhat beyond the aiming point, but may be heard in an area extending five to 20 miles in all directions from that point. Temperature inversions will move the point of maximum intensity closer to the airplane. When diving at supersonic speed, the pilot can be sure that some area will be boomed, but he can't be sure of which area.

The net result of all this is that Joe Jetjockey had better think twice before trying to boom his girl friend's house. If atmospheric irregularities foul up his aim he may boom his CO's house instead; and even if he does hit his target on the nose, a boom covers a lot of territory and his CO's house may still get a good jolt, which Joe will undoubtedly feel when he lands.

Altitude — Mach number limits for creating boom in level flight.



Shock wave patterns in steady state and transient phenomenon.


Aircraft flying straight and level at constant supersonic Mach number.
V_1
V_1
V_1
Booms Heard Here
V_1
V_1
Pressure Distributions Measured Across Waves
V_1
STEADY STATE CASE
Aircraft flying at varying supersonic Mach number and curved flight path.
Booms Heard Here
UNSTEADY STATE CASE

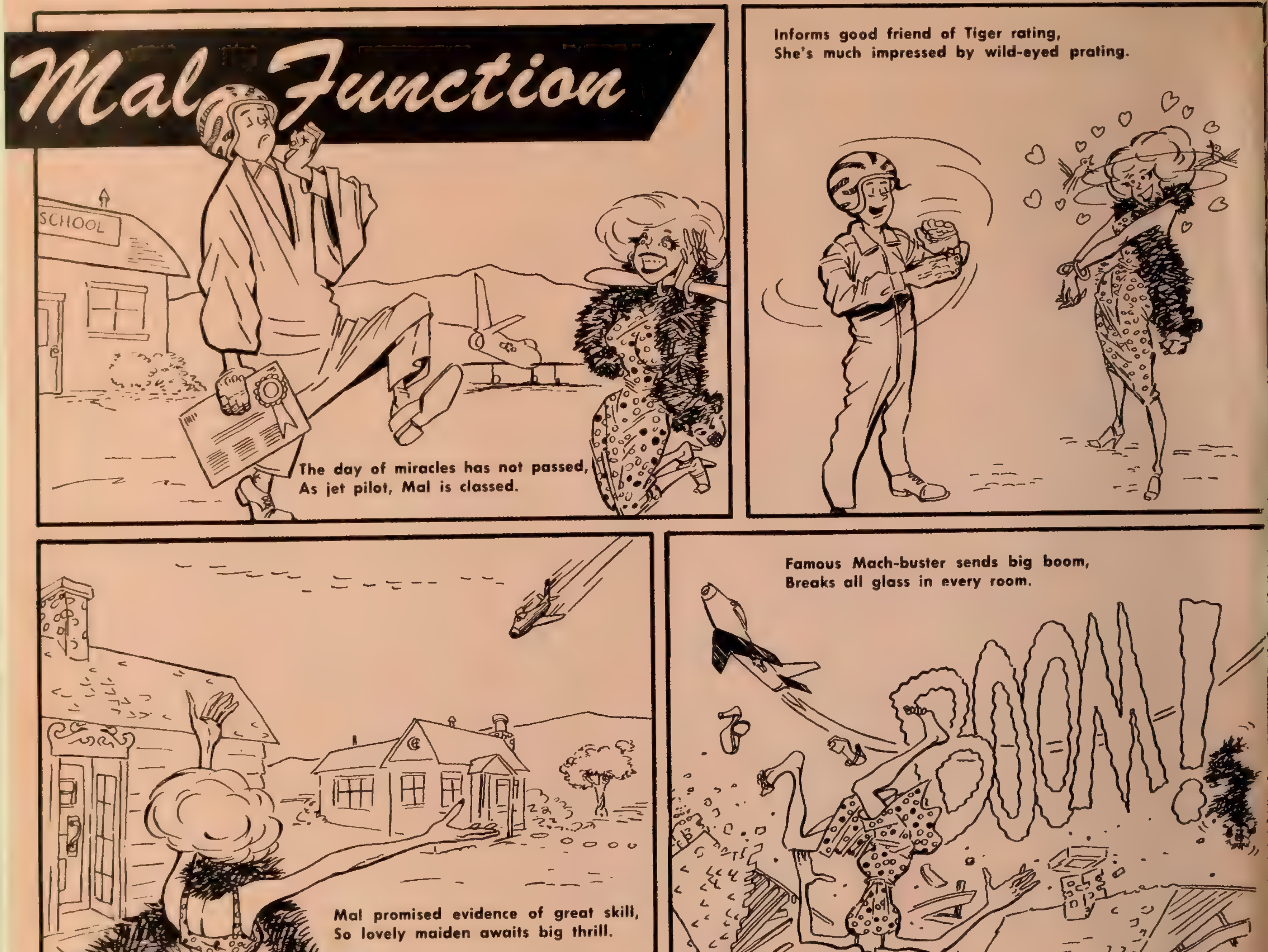
Headquarters USAF has issued instructions to the field to avoid creating sonic booms in areas where relations between the Air Force and the public would be adversely affected, and one may expect that severe disciplinary action will be taken against those who intentionally indulge in this practice. How can our friend Joe be sure of not offending? This is a difficult question to answer because there are so many variables. A number of different local regulations have been issued prohibiting supersonic flight below certain altitudes and over certain areas. These regulations are designed to minimize public annoyance from booms and should, of course, be observed. However, because there's a lot that isn't known yet about this subject, we can't be sure that the restrictions locally imposed will actually keep us out of trouble in all cases. In the absence of more specific local directives, and until such time as Headquarters USAF can provide better guidance, it is suggested that the following rules be observed:

- Avoid supersonic flight within 30 miles of populated areas, especially if you're losing altitude, and are heading toward the area.
- Avoid supersonic flight below 40,000 feet. If supersonic dives are necessary, slow to subsonic speed before reaching 20,000 feet. You'll still set off a pretty loud boom, but probably won't break any windows.
- Avoid supersonic flight within 5000 feet of other aircraft.
- Familiarize yourself with the errors in the Mach meter on the airplane you're flying. In many aircraft the Mach meter reads low near Mach 1. You're actually supersonic a little before you get the jump on the meter.

These rules don't guarantee avoidance of booms but if the rules are followed, any booms which are heard should be mild (except those from dives) and there should be no significant damage. The problem is still being studied and further tests will be conducted to determine with greater certainty just what restrictions must be placed on today's aircraft and those of the future. ●

Hold that line . . .

There are all kinds of proposals and this little lass apparently has something pretty interesting on the line right now. But, from the flyboy's point of view, just about the most important proposal is the one he telephones in to a Flight Service Center when he's trying to leap off from a civilian field. Maybe you didn't realize it, but **you** can expedite such flight plan proposals if you'll follow a few simple rules. Just look over the article that starts on page 12 of this issue and mayhap you'll find where you have been slowing yourself down.


Mal Function
SCHOOL
The day of miracles has not passed,
As jet pilot, Mal is classed.
Informs good friend of Tiger rating,
She's much impressed by wild-eyed prating.
Mal promised evidence of great skill,
So lovely maiden awaits big thrill.
Famous Mach-buster sends big boom,
Breaks all glass in every room.
BOOM!
Base Commander lives next door.
His house is gone, except for floor.
Former Tiger flees the base
With irate eagle setting pace.
BOOM
PASS IT ON

★ U. S. GOVERNMENT PRINTING OFFICE . . . 3623

624.1305
FLYS

FLYING SAFETY

UNITED STATES AIR FORCE

SEPTEMBER 1955

THE LIBRARY OF THE
SEP 26 1955

Straight Thru to Kyushu · The Little Drifter

FLYING SAFETY

VOL. ELEVEN NO. NINE

• This month we are featuring the first of a series of editorials prepared by Flying Safety Officers of five Major Commands.

• On page 26 the test pilot gives all the facts and figures on spinning the F-84F.

• Don't miss the quarterly quiz covering the last three issues of FLYING SAFETY. It's on page 28.

Next month FLYING SAFETY will feature some timely info on winter operations.

Department of the Air Force
The Inspector General USAF
Major General Howard G. Bunker
Deputy Inspector General

Brigadier General Joseph D. Caldara
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

STAFF

Editor
Major Joseph P. Tracy

Managing Editor
Captain John H. Moore, Jr.

Assistant Editor
Major Perry J. Dahl

Art Editor
M/Sgt. Steven Hotch

PRODUCTION

Major Ben H. Newby
T/Sgt. Nicholas Shekitka, Jr.
T/Sgt. William H. Johnson
T/Sgt. Carl E. Fallman
Amelia S. Askew
T/Sgt. G. J. Deen
S/Sgt. Al Fortune

CONTENTS

Page

Crossfeed 2
Straight Thru to Kyushu 4
A Preview of Tomorrow's Tanker 12
Well Done 15
By the Numbers 16
The Little Drifter 20
Keep Current 25
Winding Up the "F" 26
How Well Can You Remember? 28

★ ★ ★

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazine can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the Flying Safety Magazine. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

SAFETY Through Flight Planning

Colonel C. J. Cochrane
Chief of Safety Division
Strategic Air Command

SAFE AIRCRAFT operation requires competent flight planning. Continuous emphasis on this subject has proved to be one of the more productive fields in furthering the Strategic Air Command's aircraft accident prevention program.

In 1949 General Curtis E. LeMay, SAC commander in chief, demanded that his aircrews adopt a more professional attitude toward flying and directed that all levels of command place additional emphasis on safety of flight items. Prior to that time, flight planning all too often consisted of a quick stab at a wall map with a piece of string and a hasty fill-in job on a flight clearance form.

A not too typical, but highly illustrative example occurred several years ago when a second lieutenant was cleared in a T-6 from one of our midwestern SAC stations on a flight to transport a non-rated passenger to a West Coast air base. In an effort to make good an early takeoff, the pilot failed to plan his flight properly. As could be expected, because of the inadequate manner in which he planned the flight and his low experience level, he became lost, ran out of fuel and was forced to crash land, gear-up, on an emergency strip. During the course of the accident investigation it was revealed that a rated officer other than the pilot had prepared the charts used on this flight. Among other errors noted was the fact that true headings were entered along the intended flight path rather than the magnetic headings that this officer normally used. Before this deviation was noted, the pilot was so far off course that he never succeeded in orienting himself. In addition, borderline planning was evident in that the estimated time en route so nearly coincided with the range of the aircraft that this flight could only have been safely completed providing the pilot was able to obtain absolute optimum performance from his engine while utilizing strict cruise control techniques.

In view of the questionable practices employed in clearing this flight, the briefing officer was contacted in the course of the accident investigation. When questioned as to the adequacy of the pilot's route briefing and qualifications, the officer is reported to have exclaimed: "He had a map, a pair of wings and an airplane. What else could he need?"

Investigation of this and other accidents in which inadequate flight planning was a contributing cause factor disclosed that the mechanics and principles of flight planning were well known to the individuals concerned. The weakness lay in a tendency to rush through and gloss over this important phase of flying. Couple this with a feeling of over confidence and/or complacency that often exists among experienced crews, and you set the stage for an accident . . . via the improper flight planning route.

To combat this often fatal tendency, a new SAC directive on flight planning was written and placed into effect in July, 1953. Under its provisions, detailed flight plans must be filed with Base Operations on all flights, combat readiness training, administrative and so on, in sufficient time prior to proposed takeoff so that the flight plan can be reviewed personally by commanders. This is done to be sure that the mission requirements are within the capability of the aircraft and crew.

Specifically, this directive calls for review of the flight plan by either the tactical wing or air base group commander for the assigned or attached aircraft. In addition, detachment commanders review flight plans for TDY aircraft under their operational control. With this system all aircraft operations are continually monitored.

Every SAC mission is planned in detail with as great a built-in safety factor as can be achieved and still assure the tactical success of the mission. The reason for this is obvious. Proper flight planning, based upon accurate performance data and current weather information, can forestall many dangerous situations by recognizing and avoiding them.

Since this policy has been in effect, careful planning has paid off in a better safety record. Accidents involving improper flight planning have been reduced to a minimum.

The soundness of this policy is easy to defend since you can't argue with success. This record has been achieved in spite of the fact that air-refueling operations, both day and night, now being conducted by SAC crews on an average of one every $3\frac{1}{2}$ minutes around the clock, increased overseas deployment over non-standard routes. Continued expansion and conversion to new equipment has more than tripled our accident exposure over the past six years.

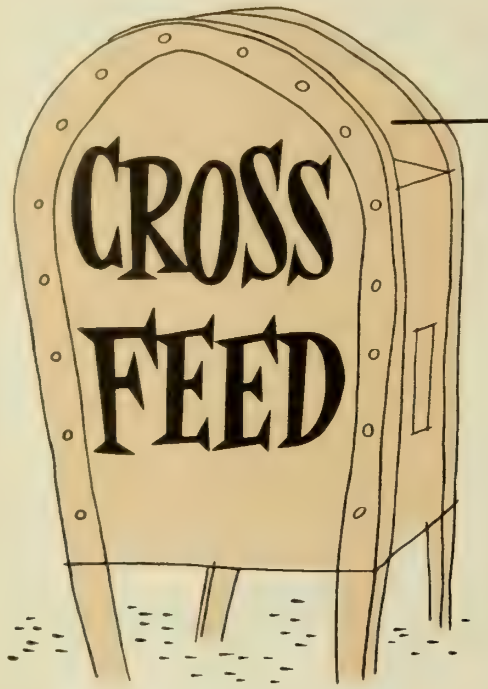
Taking the time to plan a safe flight, regardless of the type of aircraft flown, has always been sound advice. The advent of the modern high-performance aircraft and inflight refueling, however, have magnified and made even more acute the old problems of range, altitude and weather.

Also, it is a well established fact that a crew that has been airborne for a period of 16 to possibly more than 36 hours—almost a standard practice for SAC's combat crews—will need every bit of assistance they can get from thorough preflight planning if they are to safely complete their missions in today's highly complex aircraft.

Letdowns in jet aircraft are complicated by high fuel consumption at lower altitudes, and today's pilot must think and react more quickly to stay ahead of his fast-moving airplane. As a result, flight planning must be more meticulously thorough and detailed than ever before.

While it is vitally important, flight planning obviously is only one facet of a well-planned, aggressive aircraft accident prevention program. We have found, however, that flight planning, like other safety of flight items, requires continued emphasis. When commanders and supervisory personnel relax in any phase of the program, it is soon reflected in a rising accident rate.

Continued vigilance within is the keynote in the success of any accident prevention measure. No matter how many times it has been stated, "Plan your flight and fly your plan" remains the basic formula for safe aircraft operations.



CROSS FEED

LETTERS TO THE EDITOR

Crazy Climbouts

Before I get airborne, I want to make my position clear on one point. I'm firmly convinced that thorough preflight planning is good life insurance and we should all have it — it's free. I also go along with the idea that the more complex the weather situation, the more detailed the planning should be. I like to leap off knowing I have all the info. I've checked the facts and figures, slipped the stick and had the weather officer put his arm 'round my shoulder as he spoke of winds, fronts and precipitation. Whether it be a combat mission or local armchair boring, the flight is half over after you get strapped in. But where do we get this fighter pilot's life of "hours of boredom, punctuated with moments of stark terror?" I'll tell you one place — Climbout Instructions.

Recently (when I should have been at home, with my wife running her fingers gently through my hair), I tied on a pipe and leaped off on a night IFR flight with a very low ceiling and heavy rain. Departure point was Memphis NAS, destination Perrin AFB. On takeoff roll I was told to climb to 20,000 feet on the NE leg of the Memphis range. Not only is this an inopportune time to be turning on flash lights and retuning the radio compass, but it was exactly 180 degrees in the opposite direction to my destination. Sure, there was no sweat, since I had plenty of fuel for the short hop. But think what this did to all the facts and figures I labored over with the slip stick. Maybe I'm different, but in the event of radio failure I like to know at least what State I'm over — I might want to evade.

About a month ago I filed a clearance for a night 1000' on top, IFR flight. In takeoff position I received instructions to climb on top, tracking outbound from the station. The heading was approximately 45 degrees off course, and I broke out at 41,500 feet with an inoperative radio compass. The winds were a far cry from what I had planned on and I guess I would have been somewhat "shook up" without radar or DF assistance.

I realize that the jet traffic during IFR conditions presents a problem for ARTC, and I am cognizant of the priority afforded at destinations. But what can we do about these crazy climbout procedures we often get, that immediately start our flight out from an unknown point? I recommend that climbout instructions be made available to the pilot before he leaves base operations. Pilots could then plan flights more logically, and they wouldn't have sly grins on their faces at destinations as they read the sign, "Congratulations, here you are safe and sound. Did you know what you were doing, or was it just luck?"

Major Harold J. Hoffman
3555th CCTW (Int.)
Perrin AFB, Texas.

We certainly concur with the good Major in his gripe. But there is not much than can be done right now.

More modern electronic equipment is on the fire, designed to provide better separation methods. But, until this equipment installation becomes a reality, we had all better count on receiving some of these oddball climb out instructions.

Everybody should contemplate this and plan for the delay involved. Many of the boys call ARTC on the telephone about two hours before takeoff and find out what departure procedure they will get at take-off time. They figure this into their flight plan, then, provided they get off on time, they are in pretty good shape.

ARTC is cognizant of the whole mess and attempts to give on-course climbouts, but often traffic just does not permit it.

★

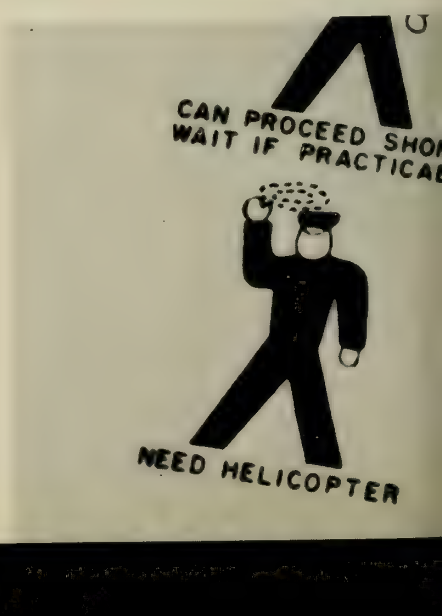
Rescue Slip

I read FLYING SAFETY every month and am particularly interested in articles concerning survival as I am the NCOIC of administering the written survival examination for the 3943d Strategic Evaluation Squadron. In reading the article in the June issue entitled "It's Better When You Help," I noticed a cut on ground signals. As far as can be determined, two of the "Little Men" are giving the same signal with opposite meanings according to the caption under them. Can you please clarify this for me?

I am inclosing page 27 from FLYING SAFETY for June with the two "Little Men" that I am in doubt about circled in red. I am also inclosing page 10 of the Survival Manual of December 1954 which does not mention a "need helicopter" signal.

I would appreciate a clarification on this signal. I am convinced other people may have some doubt in their minds. If there is a difference in the pictures of the "Little Men" as shown in the June issue, I sug-

Notice the rotating motion of the right arm.



gest their meaning be changed so no doubt will exist in the mind of the rotor pilot which signal is being given — "Go Away" or "Stay." Safety-wise it could mean a life saved. Yours for safer flying.

M/Sgt. LeRoy C. Dixon
3943d Strat Eval. Sq
Davis-Monthan AFB, Ariz.

Sgt. Dixon's point is well taken. Technically speaking, our Little Men were okay. The man signalling the helicopter is rotating his hand over his head, while the man signalling okay has his arm stationary.

However, we are in accord with the Sergeant. We suggest that if you need a helicopter, the arm be rotated vigorously overhead. (See accompanying illustration.) We have taken our illustrator to task for failing to make the figures clearer and he, in turn, passed the buck to the printer. Anyway, it won't happen again.

★

Photogimmick

Being a guy who is always on the lookout for new ideas, I thought maybe some other FSO's would be interested in this little gimmick I dreamed up in support of our flying safety program here at the 111th Fighter-Bomber Wing, Pennsylvania ANG. We're located at the Philadelphia International Airport.

The idea came to me while romping around with my kids. They get the darndest expressions sometimes. Anyway, not being a photographer myself, I made a collection of those baby portraits taken by a professional New York City photographer. It was no trick at all to mount them on pieces of white illustration board and then finish off the whole thing with a gag line. That's the meat of the thing. I just put down what the baby's expressions seemed to indicate in the vein of flying safety.

They have created a lot of comment and I'm sure that the punch line presented in this manner will stick with whoever sees them. You could probably work the same deal with animal pictures or even birds.

Capt. Edmund Galli
FSO, 111th F-B Wg
Pennsylvania ANG

Who says there's nothing new under the sun? Captain Galli's creation surely proves the old adage, "One picture is worth a thousand words." Just two words from us, Captain. Good work!

★

TWX Briefs

I think the SAC procedure of sending TWX briefs of accidents to all Flight Safety Officers is an excellent policy. Although I can only use or apply 10 to 15 per cent of the TWXs I receive from SAC Headquarters and 15th AF Headquarters, it does two important things for me. First, it helps me to channel my inspection and prevention activities into an area of most likely cause factors as indicated by the TWXs. Second, it gives me a wealth of material that is timely, pertinent and interesting to reproduce in local Flight Safety News Letters and to discuss at our mandatory Flight Safety meetings. If this procedure was placed into effect in all commands or at least numbered Air Force levels, I believe it would help the wing and base Flight Safety Officers to do a better job.

Maj. Norman W. Bernier
FSO, 814th AB Gp
Fairchild AFB, Washington

This suggestion certainly is worth passing on. The accident briefs help the good Major in performing his duties, so it figures that they could be of help to some of you other FSOs, too.

If the system isn't in effect in your command, maybe a note in the suggestion box will win you a three-day pass . . . or something.

★

Rabbit Stew

Upon completion of the Annual Inspection of the 2347th Air Reserve Training Center, Long Beach, Calif., Major George Hall, FSO for the Fourth Air Force, made this note in the inspection report: "A flying hazard exists on the flying field because of the large quantities of rabbits."

In reply, Col. Thomas Wiper, Commandant of the 2347th submitted this letter, headed, "Corrective action taken in compliance with 4th AF Annual Inspection." It read, "Transmitted is the result of corrective action taken to decrease the rabbit population of Long Beach Municipal Airport. It is estimated that this one rabbit will decrease rabbit population by some 2016."

The letter from Col. Wiper was accompanied by what else but —a rabbit, and around his neck a collar with the name "George." A very humorous but effective answer to the increasing Long Beach rabbit hazard.

Office of Information Services
Hamilton AFB, Calif.

After close consultation with several genetic experts, we find the Colonel's figures in error. Our guy tells us that the population would be decreased by only 1999. Seems he forgot to figure in a few old maids.

As for George, we'd like to know how he got that split ear? Looks to us as if some of them rabbits is the worst kind!

Flying Safety Officers find a million gimmicks in promoting safety.

Corrective action—(1) ea. photogenic rabbit complete with necklace.

Here is the answer to fast, mass movement of complete combat units equipped with gear.

Straight Thru to Kyushu

The story of how 4000 men were airlifted via Operation Gyroscope.

•

Major Joseph P. Tracy and Captain John H. Moore, Jr.

It's almost incredible how large and comfortable the crew quarters are on this bird.

SINCE THE DAYS of Caesar's Legions, one of the big problems that armies have faced is that of personnel replacement. Even as late as World War II, units in the field replaced personnel on an individual basis. Obviously this system lacked merit in many respects: untried men replaced combat veterans; experience level fluctuated greatly, and naturally esprit de corps fluctuated likewise.

Recently the Army decided to implement a program that is comparable with Air Force policies; that is, mass movement of complete combat units on a swap basis. This means that units transfer, carrying individual small arms and personal equipment, while the heavy equipment in the unit remains static.

The first mass move, made by the Army in 1955, was carried out by surface vessel. Men, dependents and personal effects were moved en masse. The program was highly successful with one exception. That was the element of time.

When it was proposed that the 508th Airborne Regimental Combat Team be transferred to Kyushu, Japan, to replace the 187th ARCT, a revolutionary plan was propounded. Since both units were used to flying by virtue of their basic mission, it was decided that a mass airlift might well be the answer. This led to the birth of the airborne phase of Operation Gyroscope, the largest personnel airlift in history, to date.

After the initial plans were formulated by key planners of both services, they were turned over to an old friend of the 187th ARCT, Major General Chester E. McCarty. As commander of the Korean airlift for two and a half years, Gen. McCarty's 315th Air Division transported the 187th jumpers into all combat DZs as well as on many day and night practice maneuvers. General McCarty's reaction to the proposed plan was typical, "We take chaos, organize it, then make it work." And initially, as in all gigantic plans, chaos was the order of the day. Involved were some 7000 paratroopers of both commands, faced with a round trip of approximately 18,000 statute miles. Here then was where the bugaboo of time could be licked.

With such a tremendous airlift in the offing and with all the obvious flight safety factors involved, FLYING SAFETY decided that this operation should be covered first hand to gain information about the many facets that enter into such a project. Consequently, through the good offices of the 18th Air Force whose 63rd and 62nd Wings were charged with physically operating the lift, we were invited to participate in the operation as observers.

Many of the safety factors involved were actually built-in as far as the 18th Air Force was concerned long before this specific project was even conceived. For example, the pilots of the participating wings receive an annual proficiency check which must be accomplished each year prior to their birthday in exactly the same way as the yearly instrument check is required of all USAF drivers. Incidentally, if this check is not accomplished or not passed, pilots are downgraded until such a time as they become current and can demonstrate that they have the required proficiency. In addition, they receive 90-day standardization checks and frequent spot checks by recognized IPs and operations personnel. Another feature of the 18th Air Force's program is their yearly instrument school of one week's duration. This is a must for every operational pilot.

The minimum standards to check out in the 18th's C-124s are 2000 hours total time and several hundred hours of four-engine time, plus 100 hours of transition in the C-124. Also, new pilots are instructed by a mobile training detachment for three weeks.

Of this 100 hours of transition in the C-124, a minimum of 50 must be spent locally, practicing normal and abnormal flight conditions, including everything from stalls to two-engine-out procedures. The other required 50 hours are devoted to problems peculiar to cross-country navigation, in-flight procedures and over-all flight planning. All aircraft commanders are checked out by a limited group of highly qualified personnel, after being recommended for final check-out by an IP.

Prior to the actual start of Gyroscope, all C-124 crews were required to participate in a wet ditching drill, wearing normal flight clothing. Further, after completing this phase of survival they were run through several dry ditching drills. This included organized procedures for dumping hatches, evacuating the aircraft and properly operating the 20-man rafts.

In the meanwhile, the Army troops were being given extensive briefing in the use of all survival equipment, such as Mae Wests, life rafts and accessories. They were drilled extensively in the evacuation of the C-124 in the event of an actual ditching. Nothing was left to chance.

As the plans were finalized, it was firmed up that each of the 43 actively participating aircraft would carry 90 combat-equipped troopers plus their personal luggage. This represented an average weight of 23,010 pounds of very important cargo per aircraft.

The engineer carries the ball on the engines, adjusting controls and monitoring instruments.

Starting at 0001 hours on 7 July 1955, the program got under way on schedule. Unlike most airborne operations, whereby many planes have been dispatched simultaneously, each C-124 was allotted a block time with a two-hour separation. This made it possible to march each load of troops to the aircraft 45 minutes prior to departure, call the rolls, personally inspect them as far as seating and safety belts go and cover all phases of additional necessary briefing.

Each aircraft was scheduled for a three-hour layover in Travis AFB, two hours at Hickam and two hours at Wake Island. This allowed time for the passengers to have a hot meal at each stop, for adequate servicing of the plane and for all necessary maintenance. At Travis a good part of the extra hour was devoted once again to additional briefing of the troops on survival equipment.

In order to carry sufficient fuel reserves for the long overwater hops, the loading ramps in the nose of each C-124 were removed along with some additional equipment deemed unnecessary for the project. As a consequence, this weight reduction allowed for almost 700 gallons of fuel above that normally carried and lent considerable weight on the side of safety.

The airlift was planned to allow each flight crew to fly one leg and then lay over for a minimum of 14 hours while the aircraft continued on with a new crew. This type of layover not only insured that the crews would get adequate rest and hot meals (which were specially planned in advance) but also allowed them to take full advantage of the excellent services rendered by MATS.

Here then we find two separate agencies within the Air Force working in close harmony. Operational control of the project was vested in MATS while much of the actual planning and all of the flying was done by the Troop Carrier Command.

At each stop a series of services were performed by MATS personnel to expedite the planned operation. Flight logs were made up by the navigation section for each outgoing crew. This relieved the navigators of a great deal of preflight planning, minimizing their workload. After checking the weather and prevailing winds carefully, the required fuel load plus reserve were figured by MATS personnel and loaded accordingly upon landing.

Form 175's including route and best altitude were made out for each pilot's signature. The radio section briefed each radio operator on frequencies to be employed and check points where position reports would be required.

Finally, each Aircraft Commander and Navigator was given a comprehensive weather briefing, including profile maps and pressure and wind charts. Then they were briefed again on the entire route, with emphasis on fixes, reporting points, minimum altitudes, NOTAMs and letdown for destination and alternate.

After considering several ways of presenting our personal observations of Operation Gyroscope, FLYING SAFETY decided to give the whole affair a journal type treatment. This is the story.

2145 PDT, 4 July:

Amid the usual confusion accompanying some hundred pounds of excess baggage, which included cameras, typewriters, film, and, oh yes, some clothing, we finally got off from Los Angeles on the first leg of a journey that would eventually embrace some 20,000 miles of air travel. This was sort of backing up to get where we were going, but that's the way things sometimes go.

0800 CST, 5 July:

We arrive in Washington, D.C. amid a heat wave and transportation strike. Best a veil be drawn over the suffering of your editors during this phase. Finally arrived at Donaldson this evening at approximately 1930 hours, during a grand daddy of a southern-type thunder shower. Checked in with the project officer

Competent and highly qualified crews assured the safe transport of their valuable cargo. Nothing was left to chance as all units received briefings on every phase of the flight. The orderly and well disciplined manner displayed by the troopers greatly contributed to the success of the airlift.

and learned that we were scheduled to depart for Ft. Campbell, Ky., about 1200 hours tomorrow.

We have requested that we be allowed to travel straight through with one plane load of troops, as we feel that this is the best way to find out how the operation actually progresses.

1200 CST, 6 July:

Finally got off about 1330 in a C-119 for Ft. Campbell. The plane was filled with a varied assortment of news media correspondents. As is normal in an operation of this size some of the details (from our viewpoint, anyway) have been neglected. For example, one jeep meets us at Campbell although there are approximately 16 passengers aboard our aircraft, all burdened down with enough personal paraphernalia to sink the Lusitania. This, in itself, presented somewhat of a problem, especially as there was a certain amount of hysteria as to where we were to sack that night.

After ironing out these small details we board an Army bus and are conveyed to a GI-type barracks which wasn't much, but it was home.

1830 CST:

We are fortunate to sit in on a briefing by General McCarty on the projected operation, much of which we have already covered in this article. The General is a past master at this sort of thing and it is surprising how easily he breaks down a complicated subject to the simplest form for the uninitiated.

We learn that there will be 43 loads of troops; that there will be 10 spare or extra aircraft stationed at the various stops along the way; that three airplanes have been dispatched ahead to carry the advance echelon of personnel who will act in a command, liaison, aerial port, aircrew or maintenance capacity. This adds up to almost 1000 people involved in the airlift in one capacity or another. No matter how you slice it, that's a lot of people to scatter around the globe.

The General tells us that most of the crews and support personnel will be furnished by the 63rd and 62nd Groups, while back-up aircraft and crews, in the event of trouble, will be furnished by other units of the 62nd TC Wing from Larson AFB.

The basic mission of the 18th Air Force is such that this is considered a routine maneuver. In reality, it merely consists of combining a series of relatively short flights into an over-all movement that will embrace about two-thirds of the world.

2000 CST:

We spend the rest of the evening discussing the troop movement with officers and NCOs of the 508th. They are all highly in favor of the expedition and we were interested to learn that all dependents have gone ahead of the main body and are now on the high seas. Most of the sponsors have taken their families to the coast and will join us at Travis. This is genuine concurrent travel, and certainly a new twist in overseas rotation.

0630 CST, 7 July:

After a hurried breakfast we went to the Movement Control Center where we reaffirmed our scheduled departure on flight number 1117, at 1600 hours. The 18th AF Project Officer and the MATS Liaison Officer have arranged for us to be carried on the Form 175 for each leg. We're looking forward to some time in this big bird.

Spent the balance of the morning shooting photo coverage of the troops being briefed, marching to their respective aircraft and then boarding. This was sort of nip and tuck between TV cameras, newsreel lads and Army and Air Force photographers, not to mention civilian PIO types. It seems like there are about two cameras for every trooper.

Our flight came in from Donaldson at 1300 hours and we met Capt. Robert S. Mulgrew, Aircraft Commander, Capt. Donald E. Knebusch, Pilot and the Navigator, 1st Lt. Conrad J. Kelliher. After a quick lunch we gather in Ops for briefing.

At this time the two busiest men on our flight are the Flight Engineer, M/Sgt. Dewey R. Church and the Loadmaster, A/3C John E. Davis. Church is busy with refueling and last minute checks, while Davis is supervising the advance part of the troopers who are loading the personal baggage of our 90 passengers. The day is sweltering hot and the Loadmaster and the Flight Mechanic, A/2C Ozro E. Ewers, as well as the Army assistants are soaking wet. We understand how they feel. Shooting pictures inside the plane is comparable with sitting in a blast furnace. Japan *can't* be any hotter than this.

1530 Hours:

Loading starts on schedule. Each soldier carries his basic weapon, duffle bag and one or two sets of cleaned and pressed uniforms. Most of the troopers seem quite young, but all in all act like real good soldiers. We gather from the conversations around us that their only sweat will be the landings. They've been trained to bail out on every flight, and landings are something they go through only when things go wrong.

As usually happens under semi-serious conditions, someone always furnishes comic relief. In this case, the involuntary clown turns out to be the representative of a big newsreel outfit. After officiously dragging several of the young soldiers around to

C Company troop commanders did an outstanding job in contributing to the overall operation.

get special effect shots, and hampering the initial loading considerably, he finally got in position to shoot the troops as they came aboard. As they started up the ramp, he pushed in front of a service cameraman and started shooting. Unfortunately, for posterity, at this precise instant the side of his camera fell open and endless yards of unexposed celluloid unrolled across the path of the boarding troopers. Big, highly polished jump boots soon ground the film into nothing, amid cries of "Wait, Halt, Stop!" from our hapless cameraman.

Needless to say this gave us all a moral uplift.

At 1550 hours, 10 minutes before block time, the engines are started as each item on the prestart list is checked off, with all personnel standing by on the inter-phone. As soon as all mills are purring smoothly, Capt. Mulgrew flips on the loud speaker system and gives the passengers a briefing of the projected flight —route to be flown, altitude, weather en route and ETA at Travis.

The radio operator, S/Sgt. Enos Childs and his assistant, A/2C Eldridge Parks report that their equipment is working properly and they are ready to roll.

At precisely 1600 hours we taxi out to the run-up area and start going through the comprehensive pre-takeoff checklist. At 1615 we line up on the active. Sgt. Church advances the throttles and we are off on the first leg of our long journey.

Our basic figures for initial takeoff on the trip were:

- Runway temperature/dewpoint- 84/72
- Field Elevation — 560 feet
- Takeoff runway length — 9000 feet
- Predicted takeoff roll — 3900 feet
- Takeoff gross weight — 177,000 pounds. (MAC 28.6%)
- Critical four-engine speed — 98 knots
- Critical runway length — 4750 feet
- Liftoff speed — 110 knots.

We note an interesting item on the bottom of the takeoff performance chart. It reads, "No takeoff will be attempted when critical runway length is greater than runway length available." To that we can only say Amen!

After the first hour or so, we all get shaken down into our respective positions and realize this is going to be a long grind. It's almost incredible how comfortable the crew quarters are on this big bird. With padded seats and room to walk around, it doesn't lead to cramped legs and tired posteriors on a lengthy haul. The office itself is arranged not only comfortably, but in the simplest manner imaginable. With the engineer carrying the ball on the engines, the pilots can concentrate on the basic flight instruments. This is simplification at its best.

Somehow it seems to us that this old lady doesn't really fly, but rather, marches in a majestic manner across the sky. She is quite disdainful of normal thermals that set lesser craft to bucking and bouncing. She merely shrugs them off with a flick of a wingtip.

Booming across Oklahoma and New Mexico we have a few brief encounters with relatively small, but quite violent, thunderstorms. Sometimes you can't circumnavigate those little dudes so then it's a case of cranking the cockpit lights way up, cinching up the traces and riding 'em out.

When you get into these sort of atmospheric antics, even the C-124 kicks up a fuss. But we found her nice and light on the controls and it was certainly no great chore to hold altitude and course.

0100 PDT, 8 July:

We start a slow, gradual letdown for Travis; our ETA is 0115. Looks as though we've hit it right on the money. We've only grabbed off about an hour of shut-eye on the trip so far, but are eager to go on. We touchdown at 0115 local time.

Immediately after landing, the Aircraft Commander holds a dry ditching drill to insure that all troops know which exit they must use for evacuation, which raft they will board and then stresses the need for orderly disembarking.

Established block times made it possible to march troops to assigned aircraft 45 minutes before departure times.

Old reliable "George" made things easier for the pilots, but it was still a long grind. We know they'll be glad of the 17-hour layover here. This shows excellent pre-planning and is an added safety feature whereby each crew is well rested before starting on another leg. They will have the same rest periods between each additional leg, and a 60-hour layover in Japan.

After grabbing a fast sandwich and cup of coffee we head back to the Control Center and meet our next flight crew. The Aircraft Commander is Capt. Ted L. Bishop; Pilot, Captain Andrew D. Curtiss; Navigator, 2nd Lt. Larence E. Landis; Engineer, T/Sgt. Charles B. Lindley; Radio Operator, S/Sgt. Kimble W. Jones; Flight Mechanic, A/1C Kenneth B. Ernst, and Loadmaster, A/2C Hoyt T. Pinson.

Once again we get off right on our block time of 0400, after an excellent briefing for all the troops by the Aircraft Commander. Included in this briefing were personal checks by the commander and crew to insure that all Mae Wests were fitted properly and that each man knew its function thoroughly. These added briefings could pay off, for one trooper had his life vest on backwards and inside out. Just goes to show that you can't get too much of this sort of thing. Everyone must wear Mae Wests during takeoffs and landings from here on in.

On this leg we have two additional crewmembers. Major H. K. Smith, observing the operation from a logistical viewpoint for the 18th Air Force and Major Stanley Lutz, Deputy Surgeon, 18th AF. They are staying with this particular crew for the entire mission. Major Lutz reports that the rest time allocated for each stop is sufficient if the crew takes full advantage of it. They should average at least 10 hours in the sack. He'll report to the 18th AF on fatigue factors, availability of hot meals for the crews, the acceptability of billets and whether or not medical care is available, if needed.

In view of the obvious care that went into this operation we believe his report will be most favorable.

4½ Hours out of Hickam:

We got real lucky and managed five hours of solid sleep on this leg. A little stiff but much relaxed. We've been down talking with some of the troops and while they're a little weary too, there's enough room for them to stretch out for some sleep.

The "C" Company Commander, Captain Vern J. Laver, says his people have much more confidence in the plane now than they had initially. At first there had been a normal amount of apprehension over the fact that there were no chutes aboard. And as always when a group of servicemen get together, several interesting, if untrue, rumors had run rampant.

Some enterprising soul had spread the word around and about the area that the C-124s would be overloaded and consequently not have enough fuel to reach dry land, island or otherwise. Another interesting fable evolved around the possibility of three-engine operation. This tale went that these big birds couldn't remain airborne with one fan feathered. The excellent briefing given at the start of each leg laid the former rumor to rest and the fact that one C-124 went back to Travis with one fan feathered, after being an hour out successfully scotched the second tall tale.

Weather is good on this leg and we are getting an extra bonus in the form of a tailwind slightly stronger than forecasted, so we'll probably beat our original ETA by about a half hour.

We've been flying above a broken to solid cloud layer but occasionally we can see the ocean below. Evidently there's a fair surface wind, as the white caps are dancing across the sea in endless rows.

1130 Territory of Hawaii Time:

Only a few minutes out of Hickam and we get a lucky break. The clouds below dissipate and there lies Diamond Head, sparkling in the sun. We've seen it before, both from the air and from the deck of a ship, but to us it always represents a big thrill.

Oahu is as beautiful as ever—the deep blue sea, the white and yellow beaches and the sparkling white clouds all mix in with the overlying green foliage and the pastel houses. This place we like much.

1215 Hours:

Arrived okay and checked in with our new Aircraft Commander, 1st Lt. Herbert W. Austin and Pilot, 2nd Lt. Myron O. Jensen. They tell us that we have a bit less than an hour before we get set to leap again.

This is sort of a shaker. It's got to be either chow or a shower. We elect the latter, for our coveralls can almost stand alone at this point.

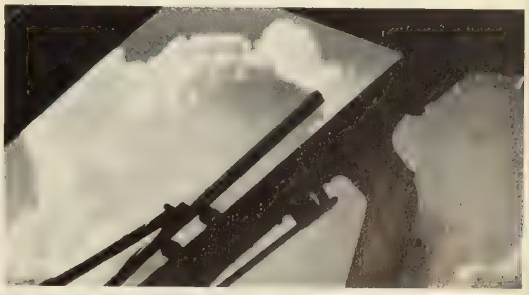
We rush down to transient billeting and rent two towels and two cakes of soap, scrub off several accumulated layers and scrape off some of the more outstanding bristles. At this point tragedy rears its ugly head. A little foresight enabled us to bring a change of sox and underwear. The shorts and shirts go on okay but in our haste to get into clean sox, we manage to tear one in half. Having no choice, we wear it anyway. At least it's clean, even if a bit drafty.

Now comes the bad part. We climb into the same old flying suits that are now beginning to show a little wear and tear around the fringes.

With time running out fast, we dash back to the plane, secure our luggage and transfer it to the new aircraft that is set up for the next leg.

Hickam is designated as a plane change base. Our old aircraft will

Right on schedule the clamshell doors swing closed, the big bird takes off and Operation Gyroscope is underway.



Frequent crew changes insured against pilot fatigue, a big factor on the side of safety.

•

After flying half way around the globe the troopers eagerly eye the Japanese mainland.

•

Flimsy Japanese houses indicate termination of this history-making airlift of personnel.

stay here for at least 12 hours while it's gone over with a fine tooth comb. This includes a normal post-flight inspection and all additional maintenance that is found to be necessary.

1325 Hours:

We leap off on schedule after another comprehensive briefing by the crew. This clockwork precision is still amazing. It is here that we learn that each crew is competing for the best record as far as making block times and ETAs on the money.

The Navigator, Capt. Martin Nisker, gets out the tools of his trade shortly after takeoff. He is in the process of checking out a student navigator, 1st Lt. Isiah Johnson in the intricacies of overwater navigation.

The Radio Operator, S/Sgt. Jean W. Granade, cranks up his equipment and settles down for the long standby watch. Now and again he chats with some unseen station. In the meanwhile the Loadmaster, S/Sgt. Johnnie L. Blaney rides herd on the troops. He makes sure that all is well and that everybody is getting a fair shake on the available floor space. That gets to be a precious commodity on a long haul.

Sometime later we get the opportunity again to fly this large bird. Things are going along smoothly although we're mostly on the gages, with little or no horizon reference. Lt. Austin is checking the APS-42 radar unit; giving us steers around the large cumulus build-ups in this area. We think this is one of the finest gadgets ever invented, for it not only pin-points all thunderstorms, but also insures a comfortable ride.

As we are chugging along, a red light suddenly flashes on the instrument panel. Naturally, we're a little shook and flash a quick query at Lt. Austin, who grins and says that the Flight Mechanic, A/1C Kenneth J. Wilson, is making an engine check. This is done immediately after takeoff, and once every four hours thereafter, while a tunnel check is made every hour. The red light comes on when the firewall door is opened during the engine check.

Having been exposed to a few red lights that, in our day, meant trouble, naturally we were relieved to learn that this was a routine affair. As much as the ruby flash can make us jump, we have to go along with the system. Nobody will ever take off with a warning light in his eyes, and this is a positive indication that something isn't secured.

We fly on into the night and cross the International Date Line somewhere around 2030 T.H. time. Seems sort of funny to have a day whacked out of your life like that, but, we'll pick it up on the way back.

We were extremely interested in the engine analyzer which is standard equipment on all 18th AF C-124s. Probably our interest was whetted somewhat by the fact that our sister publication, the Aircraft Accident and Maintenance Review recently had a very good coverage on this subject. Our Flight Engineer, T/Sgt. Darrell W. Bulis, gave us a real rundown on the capabilities of this gadget.

He tells us that, "This is the greatest gimmick ever invented.

"For example," he says, "every hour in flight I go over all four engines carefully. Funny thing though, I can sit here in my airborne swivel chair and do in two minutes what used to require hours on the part of maintenance men.

"Take a fouled spark plug. These engines might fly for hours and I'd never catch it. Sure, I'd know there was something wrong. The engine would probably run a bit rough, or, if several plugs were bad, the gas consumption would go up. But by using the analyzer, I can spot a bum plug right away. I can tell if it's merely fouled or actually not firing. I can determine exactly where it is and further, can determine why it's not functioning right.

"Let's say that we find a plug that's getting leaded up; in fact, usually there will be several. Okay, I find out which plugs are involved and then depress the primer buttons for a minute. This doesn't hurt the engines at all, but the sudden temperature change from a cruising lean mixture to one that's very rich sets up a fast chemical reaction and within 60 seconds or so, the lead deposits break down and the plugs commence to fire normally again. I recheck 'em with the analyzer and that's that.

"Of course, there are many other checks I can make," Sgt. Bulis went on. "By using the analyzer I can check all magnetos for timing. It's possible to determine accurately when the points open and close, or if any pitting or fouling has occurred."

The sergeant cranked a couple of dials while we watched. A myriad of exciting light lines dashed and danced across the green-colored viewing screen. Flashes of light zigged and zagged here and there with confusing jumps. It was all happening so fast we found it difficult to follow.

"See how nice that mag is timed?" queried the old Sarge. "You can see that it is right on the money." Of course we had to agree. Any fool could see that the mag timing was perfect. The fact that four engines were growling away in perfect harmony didn't influence us a bit. The fact too, that the lines on the screen looked all the world like our last cardiograph merely proved that we understood the system perfectly.

"That isn't all that we can do with these things, either," continued Sgt. Bulis. "Naturally, we want to get the best fuel economy out of our engines. That's sort of essential when you're covering a few thousand miles of ocean. By using the analyzer, we can check the mixtures. It shows up fast if it's too rich or too lean. Here, you can see what I mean."

He did some more dial twirling and the lines on the screen grew positively hectic. "See that? A perfect mixture for this altitude. That's the best fuel consumption, and the best ratio for engine life, too."

We asked Bulis if the analyzer could perform any other feats of magic? "Sure, one of the handiest is graphically depicting the synchronization of the engines. Watch."

Flipping the throttle lock off, he nudged one throttle back a fraction of an inch. Personally, we couldn't feel any difference in the beat of the engines. The tachometers still registered 2050 rpm, but the analyzer went stark raving mad. Light lines danced with fury across the glass dial and at that moment the Aircraft Commander called on the inter-phone, "Pilot to Engineer, check the synchronization."

Sgt. Bulis grinned, "That lad's sure got a good ear." We had to agree. However, we mentally reserved the thought that the "good ear" was in all probability a super-sensitive feel. Good pilots develop that capacity early in life.

Maybe we're showing our age, but things are getting just a bit more than a little on the tired side and the runway lights of Wake Island are a welcome sight. This has been good flying and mighty good navigation. Even though we picked up the Wake range almost four hours out, Capt. Nisker has plotted our position right down to a fraction of a mile all the way in.

0010 Hours, 10 July:

We're taxiing back in to the line. Thought that we were on the way again but the old engine analyzer pays off by telling us that we have a dead magneto on No. 4. That's funny too, for we were batting a thousand when we came in, but that's life.

This is unfortunate for many reasons. Primarily because flight 1117 has been hitting it right on the nose all the way across. This will shoot our schedule to you-know-where. Another thing, some of the other flights are starting to stack up a little and we'll soon have them catching up with us on hourly, rather than two-hour intervals. Best we get hopping.

It's now 0130 Wake time and the advance maintenance echelon has come through in fine style. The bad mag is changed and we are once again upon our way. We're glad, too, because we're now getting mighty tired. This has been a long grind.

Unfortunately, things don't go just as we wish. We were lined up on the runway and the Engineer was advancing throttles to takeoff power when he suddenly pulled 'em off and we taxi back in for the second time. Now what?

We finally ascertain from the crew that the almost impossible has happened—no one can find the Form 1. We shake down the entire aircraft, with all of us pitching in to find the errant form. It just ain't here. We finally shut down and crawl out again, still earthbound on the rock known as Wake. After a lengthy search, the mystery of the missing form remains unsolved.

Time is running out, and the Liaison Officer orders us to proceed, starting a new Form 1. Finally at 0300 hours Wake time we charge down the runway and thunder off into the black of the night. It's high time too. The troops are starting to show a little stress and strain. They've been a long time coming and this extra delay hasn't helped a bit.

We figure the only place for us is in the pad. Again we get five hours of intermittent sleep as we ricochet between the bunk and the bulkhead during the penetration of several high, towering cumulus. Old "George" did his best though, and it wasn't really too rough.

0912 Hours:

We all get a large lift; the Navigator comes back and tells us to look out, dead ahead. There is Mt. Fujiyama rearing up approximately 100 miles away. The weather is clear now and visibility is excellent. The sight of land does something for all of us after a long overwater haul.

We go down into the passenger compartment and are surprised at the appearance of the paratroopers. Each one has on a fresh khaki uniform, with highly polished boots, and all of the men are clean shaven. These guys are good. We know how tired they really are but when they come off the airplane at Ashiya, they intend to disembark with their heads up, chests out, and in good formation. They'll do it, too.

Troop Commander, Capt. Laver and his assistant, 1st Lt. Russell B. Morgan, have done an outstanding job of keeping morale high. We are proud to have been a small part of "C" Company, 508th ARCT, if only for a brief 60 hours.

We skim down the coast of Japan, noting Miss Fuji on our right and arrive at Ashiya at 1116 local time. This has been an experience we will never forget and we've learned a great deal about safety of flight as it is practiced by specialists, like the 18th Air Force.

The close liaison between the Army and the Air Force has been an eye-opener. Operation Gyroscope may well pave the way toward a completely new era in safe, mass transportation of armies from any point in the globe to home and back again. ●

The prototype Boeing 707 with 200 flying hours behind it is destined to be the new KC-135.

...a preview of TOMORROW'S

A. M. "Tex" Johnston, Chief of Flight Test, Boeing Airplane Company.

The Boeing KC-135 is in production as the standard jet tanker-transport for the Air Force. Details of this airplane have not been revealed. However, the KC-135 is an advanced version of the Boeing 707, a prototype jet tanker-transport which has nearly 200 flying hours behind it. The experience has provided an idea of what will be in store for crews of the advanced version, the KC-135, when it comes into service.

The following article was prepared for FLYING SAFETY by the pilot who was in command of the 707 on its initial flight, July 15, 1954.

The 707 has flown at speeds well over 600 mph and at altitudes above 42,000 feet. It has operated from a 5400-foot runway with no difficulty.

★

ANYONE WHO FLIES professionally has at one time or another taken off in an airplane with a

The 707 on final approach affords a good view of the four segment flap arrangement.

When the 707 turns KC-135, getting up and staying with the big boys will be no sweat.

ANKER

The spacious interior provides ample space for lots of cargo and over 100 passengers.

cockpit layout that made him wonder if the instruments had been laid out by firing a shotgun load of dials at the panel. He knows, too, of twin-engined airplanes whose cockpits are complicated by confusion until they are as difficult to find anything in as the cockpit of a four-engined airplane; and he has seen airplanes that require a third man up front to keep track of what is going on.

Such airplanes make the Boeing 707 stand out as a welcome change.

Maj. Gen. Albert Boyd, Commander, Air Research and Development Command, flew the 707 last October, and he had this to say about it:

"From a pilot's standpoint, it is a simple straight-forward plane and very delightful to fly."

In this article an attempt will be made to show why, from the pilot's point of view, the 707 is "very delightful to fly." I consider that this will be good information to bring out in a magazine devoted to flying safety, since only a safe airplane can be pleasant for the crew to operate.

An airplane designed with the pilot in mind is the only kind that will turn out to be pleasant to fly, and the 707 is a good example of an airplane designed for the crew.

The airplane provides the pilot with an excellent field of vision. To aid this objective the designers put four windows in the roof of the cockpit, two above the pilot and two above the copilot. Consequently when the airplane is banked, all that either man needs to do is turn his head to see out. This is a considerable advantage when turning from base leg onto final, in fact during any turn.

Visibility from the cockpit is very good. Even the frames of the windows have been slimmed to allow good vision past them, an eye on each side.

In the cockpit, the number of controls and instruments has been reduced to about 50 per cent of the number in the KC-97 Stratofreighter. It has 115 fewer power-plant controls and instruments than the Stratocruiser. Two men, pilot and copilot, can operate the 707 with no strain whatever. In fact, I think it's easier than flying the good old C-47.

The main thing that has simplified operation of the 707 is its jet engines. A jet-engine control is as uncomplicated as a broom handle. It's a single lever mechanically connected to a hydro mechanical regulator on the engine. Push it open and the engine accelerates. Pull it back and the engine slows down.

Another characteristic of jet engines is the fact that there is practically no warm-up period. When you start the engines you are ready to go.

When in flight there is almost no vibration and very little engine noise. In these respects, as in many other ways, jet engines are superior to piston engines. About the only noise the pilots hear is a slight whine from the turbines and the sound of air whistling over the nose structure.

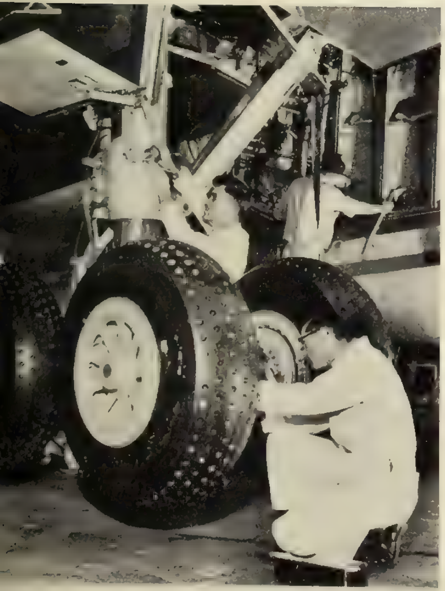
Besides being quiet and smooth, a trip takes less time due to the high speed capabilities of the airplane. When you add that the 707 is almost as comfortable as a rocking chair, you can see that these factors go a long way to eliminate crew fatigue at the end of a long flight.

Basic flight controls and instruments of a jet are the same as on any airplane, but the design engineers who planned the 707 cockpit were thinking about the pilot all of the time.

Another thing that has been done in the interest of safety is to orient engine instruments for fast, easy checking. Engine instruments, having indicator needles, are set so that during normal operation all needles are parallel. A pilot can inspect a whole panel at a glance. All he needs to look for is a needle that is off parallel. This is a great improvement over having to inspect each individual instrument.

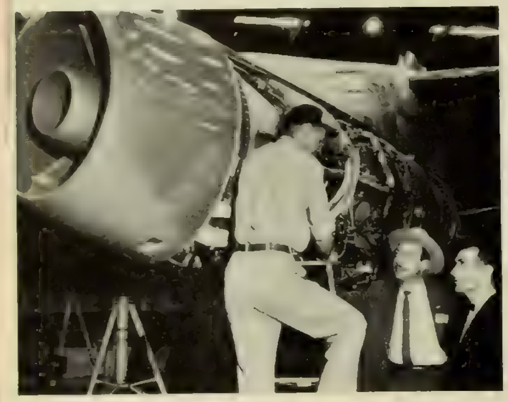
In flight, the 707 has better lateral control at all speeds than any known airplane of its size. Spoilers and inboard ailerons between the two segments of flap operate at high speeds. At low speeds, when the flaps are down, outboard ailerons come into operation.

Ailerons, elevators and rudder are all internally balanced and spring-



Mechanics go over the anti-skid tires and check the new boom installation prior to flight test.

Above, the 707 in contrast to KC-97 tanker. Below, low slung engines are handy to work on.



Below, the cockpit is evidence that designers always remembered to keep the pilot in mind.

Below, test equipment provided valuable data used by designers to iron out trouble areas.

tab operated, with the tabs connected by cables to the pilot's wheel and rudder pedals. Use of internal pressure balances gives the controls good feel and avoids both sluggishness and over-sensitivity.

Of all the flying controls, only the spoilers are mechanically boosted. In addition to helping provide lateral control, the spoilers are used as an air brake. By raising the spoilers on both wings, the wing lift is decreased and the drag increased. This feature makes possible an increased rate of descent if required.

The landing gear can be lowered at high speeds to increase drag and slow down the airplane, or increase the rate of descent.

Rate of climb of the 707 is much better than that of present-day transports. R.L. Loesch, my copilot for the early flights and captain of the 707 for later flights, says, "She goes up like a scared cat."

The airplane's performance with two engines out on one side is the answer to a pilot's prayer.

Takeoff and landing speeds and roll distances are about equal to those of a large piston-engine transport airplane. The good lateral control makes possible crosswind landings without any sweat.

Like the B-52 and the B-47, the 707's engines are in pods supported on struts below and forward of the wing. This isolation of the engine from the wing structure means that engine fires wouldn't be as serious as they would if the engines were in the wings.

In the 707, each engine normally draws fuel from its own individual tank. Two electric boost pumps in each tank, each on a separate electrical system, mean plenty of reliability. If both electric pumps should fail, and that's a very remote possibility, an engine-driven fuel pump will provide fuel to the engine. There is also a manifold line which makes it possible for any engine to use fuel from any or all tanks.

The hydraulic system on the 707 also features dual reliability.

The airplane's systems were tested and its performance characteristics have been determined during lengthy and carefully conducted tests. The tests made during each flight are very carefully planned and carried out, as much as possible during the time spent in the air. Tests flown to determine the stalling speeds and flying qualities near the stall may be used as an example to show the type of procedure followed.

Our specification sheet stated the airplane's weight for the tests, the various centers of gravity which should be used, the altitude at which the tests should be made, what flap positions were to be tested, and other essential requirements.

The basic data to be obtained were time-history plots of the stalls. These plots represented airspeeds, altitudes, control positions and forces, pitch angle, normal acceleration, rate of pitch, bank angle, thrust measurements, and outside air temperatures.

Each run in these tests was initiated from a trimmed straight flight, speed 40 per cent above the stall speed with idle thrust. We made successive runs with the flaps up, flaps at 20 degrees, flaps at 30 degrees and so on.

As the stall was approached on each run, the air speed was decreased at a predetermined rate. We observed the stall warnings, the control effectiveness, roll and pitching tendencies and the recovery.

Instruments on the plane recorded all the necessary data. The data were brought back to the flight center and reduced to their most useful form by special equipment and specially trained employees, before being turned over to aerodynamicists for evaluation. The speed and efficiency of this operation are reflected by our flight testing progress.

Other information also is obtained during a flight such as described. Takeoff performance and climb data may be taken during initial stages. Stability and/or performance data may be obtained following the stalls and fuel tank pressure information taken during descent. Braking information is obtained during landing and roll-out. By planning test flights in minute detail in this manner, every possible minute of test time is productive.

Even by the time we had completed the initial stage of Phase I flight testing, we had learned that the airplane was even better than the designers and builders had anticipated.

During the test program, we have encountered a few bugs which have been straightened out—that's what a prototype is for. I'm already looking forward to flying production models evolved from the 707, and I have no doubt they will be even better airplanes, due to the extensive test flying program. ●

Captain

Merrill H. Cross

3510th Combat Crew Training Sq
Randolph AFB, Texas

WELL DONE

KNOWLEDGE • TRAINING

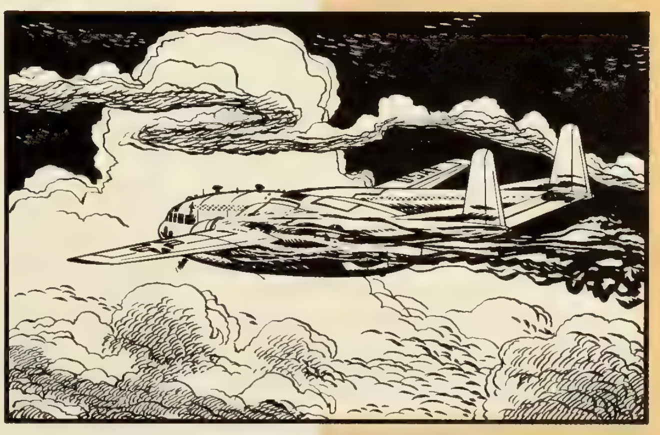
CAPTAIN MERRILL H. CROSS was the instructor pilot on a C-119 on a flight from Randolph to Tyndall AFB. After being airborne for approximately two hours, the left engine became rough. Shortly thereafter it backfired several times, then burst into flames. Captain Cross immediately feathered the propeller and succeeded in extinguishing the fire.

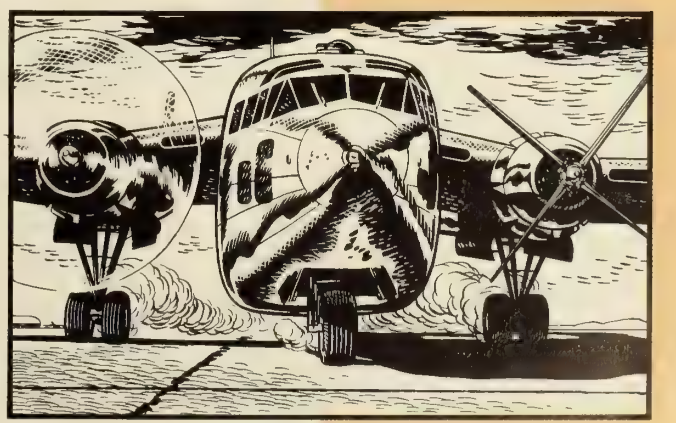
The flight was being conducted in the soup as Captain Cross declared an emergency. He received letdown instructions, reported over the Mobile VOR and requested a GCA to Brookley. The weather was reported to be 200 feet obscured with two miles visibility in snow.

GCA had considerable difficulty in maintaining radar contact as the aircraft was turned onto final approach. Finally at 500 feet, contact was lost completely and a go-around was initiated. Another 300 feet was lost as the gear was retracted; however, Captain Cross was able to climb out to 1500 feet. Another GCA attempt also resulted in lost radar contact on final and once again a single engine go-around was completed.

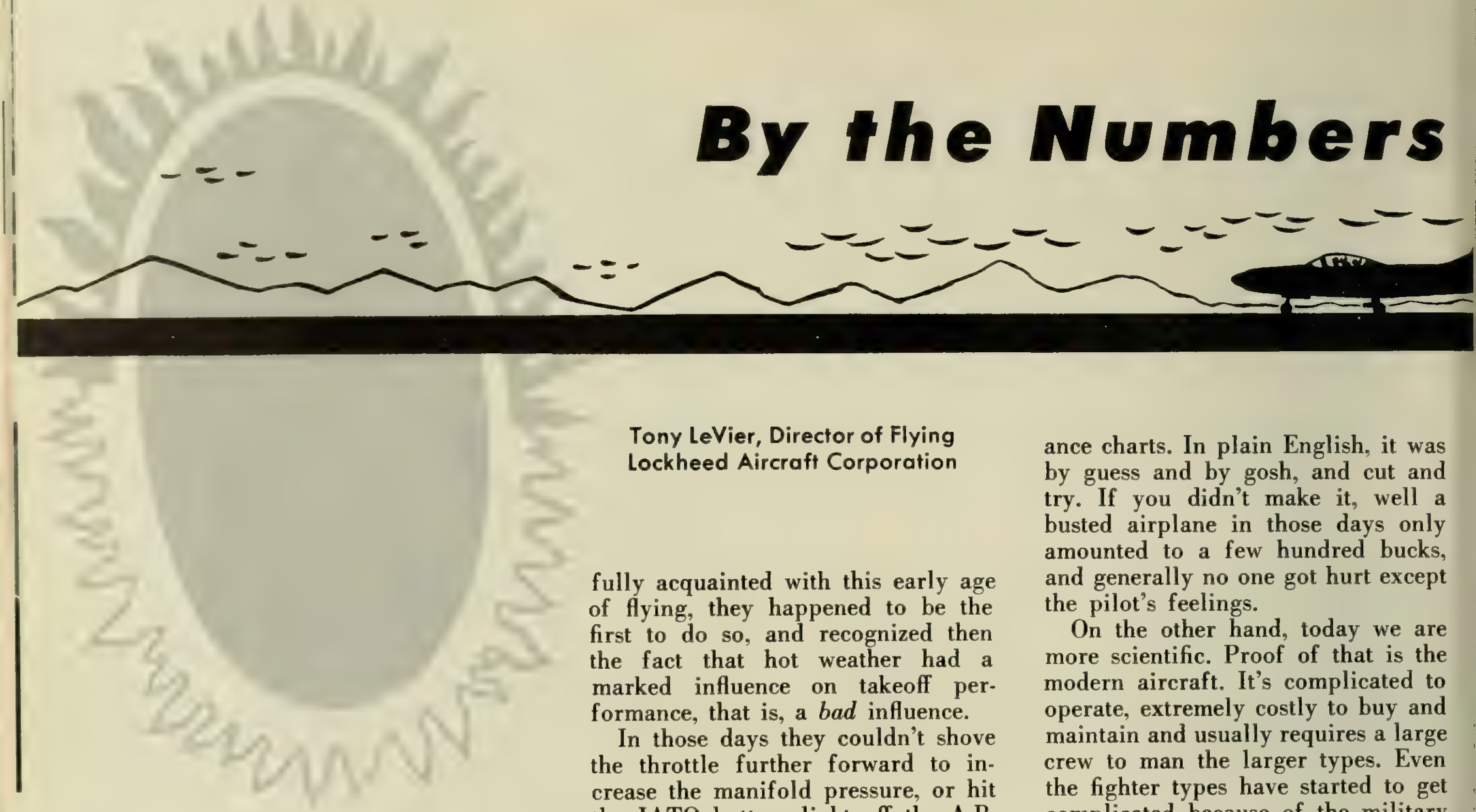
After the second GCA attempt, Captain Cross contacted a nearby civil field and started an ILS approach. He broke out at 150 feet, lowered the gear and landed with a 25-knot tailwind on the 5000-foot strip. Upon touching down, the propeller on the good engine was reversed and a safe stop was made.

The professional manner displayed by Captain Cross in handling his aircraft and his knowledge of instrument procedures and techniques are a credit to himself and to the United States Air Force. WELL DONE!





By the Numbers



Tony LeVier, Director of Flying
Lockheed Aircraft Corporation

IN THIS MODERN jet age I have always said that summer weather brings on three things: vacations, sunburns and long takeoff runs, particularly for jet aircraft.

As soon as hot summer weather sets in, there's always an upsurge in takeoff accidents. It's really funny to hear all the various reasons why one guy went through the fence after an aborted takeoff; another blew out a set of tires and wrecked both wheels; and gear was retracted on another, and so on. The pattern is the same regardless of who you are or what language you speak — *Hot weather busted aircraft!* Okay, what's the reason? Simple! Matter of fact, you know good and well what causes it. Some jockeys say "Cripes, I had a loss of power," or, "It just wouldn't accelerate," and, "I racked back on the stick but she was glued to the ground." So, it's blamed on the engine and rightfully so, but not for the right reason.

Let's go back a few years and sort of review the problem of *hot weather* or, to the intellectual type of person, "*High ambient air temperature,*" and its effect on aircraft takeoff performance. Matter of fact, let's go back to the year 1903 when I believe a couple of brothers named Wright designed and built a flimsy sort of contraption called an aeroplane. For those not fully acquainted with this early age of flying, they happened to be the first to do so, and recognized then the fact that hot weather had a marked influence on takeoff performance, that is, a *bad* influence.

In those days they couldn't shove the throttle further forward to increase the manifold pressure, or hit the JATO button, light off the A.B. or use the water alcohol. They were lucky to even have what they had. Know what they did to solve the problem? They took advantage of the cool sea breeze at a place called Kitty Hawk, and later on used such scientific methods as taking off on the down slopes of hills, or flying early in the morning and late in the afternoon. In marginal conditions they would use a fish scale to measure thrust. If it pulled 60 pounds, OK.

Okay, I know you are fully aware of the fact that hot weather affects the power of our engines and lift of our wings. You should know, you have had the finest aviation training money can buy, and this was part of it. 1903 — 23 — 43 — 53 or now 1955 — it's all the same — temperature still has the same effect on aircraft takeoff performance, *except* we have it a lot better than the old timers on most every count. That is, all except when we have a crash resulting from a failure to become airborne.

My early flying experience taught me to respect hot weather and when confronted with a takeoff on a short strip, head into the wind, if any, use all the runway available, *and allow the aircraft to accelerate to takeoff speed before attempting to lift off, in spite of your feelings for doing it sooner.* Of course, this was not a very scientific method, but then we didn't have handbooks of instruction in those days with takeoff performance charts. In plain English, it was by guess and by gosh, and cut and try. If you didn't make it, well a busted airplane in those days only amounted to a few hundred bucks, and generally no one got hurt except the pilot's feelings.

On the other hand, today we are more scientific. Proof of that is the modern aircraft. It's complicated to operate, extremely costly to buy and maintain and usually requires a large crew to man the larger types. Even the fighter types have started to get complicated because of the military requirements. Therefore, they too are a very costly article. Not all air bases have runways of adequate length for jets and at times they are found to have a marginal takeoff performance in hot weather. At this point, I might mention that my introduction into the jet age, some 12 odd years ago, was during the beginning of the summer months when the ambient air temperature at ground level in the shade was often above 100°F. I remember one time when we flew (if you can call it flying) when the mercury hit 115°F. I believe this incident stands out in my mind above all others.

It was a test flight and the elevation was approximately 2300 feet. I didn't have a runway, thank God for that, but instead I had 3½ miles of dry lake bed. I knew I was going to use plenty of run because I had rolled some 10,000 feet on a previous takeoff with lower outside air temperature. To make a long story short and not to bore you with my problems, it took 15,000 feet to become airborne, and then I wasn't sure if it would stay there. During the ensuing few seconds it took to make up my mind what course of action to take, it was too late to do anything but pull the gear up, hold her steady and straight and hope! Had I chopped the throttles and aborted, it's anyone's guess what the outcome would have been. Finally, after several minutes of straight flight, I had gathered enough speed and altitude to assure myself of being out of any immediate trouble. To give you an idea what a terrific effect this high outside air temperature had, in addition to the takeoff, I flew 30 miles in level flight accelerating to best climb speed.

This little incident (if you can call it little) took place at Edwards AFB. I was test flying Lockheed's penetration fighter, the XF-90, a twin jet aircraft of monstrous proportions and underpowered, to say the least. We were not as yet blessed with afterburners and JATO equipment, a fact which nearly put us out of business. There was one guy who was more impressed than all of the others — and that was myself.

In the experimental test flying business, one can write off some of these so-called 'goofs' by the nature of our profession, and it is generally done even when an aircraft is washed out. However, *it is an unwise pilot who doesn't figure his chance pretty close when things look marginal, like high ambient air temperature for takeoffs.*

Let's take a look at the conditions that I was flying under on this typical Mojave Desert summer day and see what the "numbers racket" brings out. First off, to get you warmed up to my clatter, we must understand that the loss in jet thrust due to high ambient air temperature is *four to five times greater for a jet engine than that of a piston-type engine.* This fact is not generally known except by engineers and then only those dealing with aircraft and power plant design. I was fortunate enough to be working with engineers fully aware of the importance of temperature.

When the temperature is high, the thrust is low — but how much? For each 10°F above the so-called sea level standard temperature of 60°F, the thrust of a jet engine is reduced by four to five per cent. It is very seldom that we are favored with the so-called standard temperatures in the summer time. All normal performance figures are based on these *phoney standard sea level conditions* which, of course, when quoted make performance of aircraft look good. Throw in a few extra degrees of temperature and your performance is shot. Then, of course, when we talk about the jet engine alone and its *rated thrust,* we must realize that this rating is for the engine running at sea level in 60°F. air and *not installed in the aircraft.* Installation takes another toll in thrust depending on the type of aircraft we are talking about. What's left to push the aircraft in many cases would astonish even the pilots who consider themselves to be "tigers."

Okay. Ready? The XF-90 penetration jet fighter was powered by two Westinghouse axial flow J-34 turbojet engines. The original design and performance of the aircraft was based on engines each producing 4000 pounds of static jet thrust at sea level standard temperature without afterburner. We got engines that would produce only 3000 pounds of static thrust, down 25 per cent thrust to begin with. Now, install the engines in the aircraft and we drop another 200 pounds per engine installation loss and end up with 5600 pounds total static thrust. Static thrust is what is measured when the aircraft is at rest on the ground. Well! So we have only 5600 pounds of thrust. Sure — lots of jet aircraft are flying around with less, but the XF-90 was no ordinary critter. It happened to have grossed out at a hefty 33,000 pounds plus, full up, lugging everything but the kitchen sink. This day, however, we were grossing out at a mere 25,000 pounds for obvious reasons!

I'm ready for takeoff. I have taxied to the extreme north end of Muroc Dry Lake — my tail pipes are almost poked into the boon docks. I move the throttles forward until they are against the stops; the tach's steady at about 101 per cent rpm — all I can get and, boy, I well need it today! I release the brakes. Does the old girl jump? Negative! She barely waddles forward without any doubt in my mind that this is going to be a distance record for an aircraft takeoff roll. Well, let's see how much actual thrust I had at the start of my roll. We can take 60°F. sea level standard and subtract 8°F. to get down to the standard day temperature of 52°F. at 2300 feet above sea level. Subtract this supposedly standard 52°F. from my actual 115°F. and we end up with it being 63°F. above standard conditions — and all just for me! Now, 63°F. divided by 10, multiplied by 4, is about 25 per cent less static thrust. Take another 2 per cent drop per 1000 feet elevation and, well! I think you are beginning to catch on.

Remember — our installed thrust is 5600 pounds. With a 25 per cent loss because of high ambient temperature and another 5 per cent for altitude we now have but 4000 pounds static thrust, or 1600 pounds less than we would have on that so-called standard day at sea level. Boy, that ain't hay! Now the trick in figuring this out so that you don't fool yourself is to remember that even this 4000 pounds isn't all available to kick you in the pants. On takeoff there is rolling friction of the wheels and the air drag of the airplane to overcome just to hold speed, let alone accelerate. These factors eat up another 2000 pounds at the average speed during takeoff roll. Sooo, now, if you're still with me, you will see that my fine engine specification kick in the pants of 6000 pounds is down to a measly 2000 pounds! Why I can hardly feel it push at all.

I move ahead slowly — the acceleration is less than one tenth of a G. It should have been three times as good on a normal day. I roll past the 5000-foot point and my speed is 60 mph V_1. Ordinarily, I would be preparing to hoist the old girl off after rolling this distance at a comfortable 160. The lake bed stretches ahead as though it were endless. The heat waves and mirages have everything floating above the ground and they look to be ages away. I roll on. My speed indicates 130 and I'm past the 10,000-foot marker. Now I'm sitting erect and my mind is starting to calculate my percentages. The indicator appears to hardly move as I start easing back on the stick at 150 mph, indicated. At this speed the old girl would have lifted off, but I knew that I would have settled back and my chances would have been shot. I'm approaching the point of no return — I like to lift off at 165 — I lift into the air at 160 — I'm skimming the dry lake bed barely inches high. Suddenly I realize my mistake trying to be a hot test pilot and get that test flight off at any cost. I know what it's like to clobber an airplane. My record is far from lily white. I raise the gear lever and say a silent prayer. Hang on, LeVier, this is going to be a close one. Gear up. Flaps still down — don't dare to raise them now. The large expanse of the main test base looms up smack on the nose. I ease into a very gentle left turn to avoid the base and skirt the full length of old Roger Dry Lake. Gad! What a wonderful place to have. I pass the main base runway at 185 mph indicated. I'm six miles from start of roll and three miles from lift off. You figure it out, boy! I'm shaking all over again re-enacting this incident. Needless to say, from that moment on, we all, and I mean all, started to get our heads together a little closer and start using them. The immediate answer was JATO. It solved our problem until afterburners were installed and we went on with our testing without trouble.

Okay, let's pick up from where I left off on the figuring. The conditions during roll were lousy, but let's look and see how *really* sorry they got at the 15,000-foot marker at 160 mph indicated when I started to fly. Having lifted the old girl into the air I managed to lose just about all the excess thrust I had, which wasn't very much. Why? Because now I'm airborne with flaps and gear down and a grand old lift-drag ratio of about six. Now a 25,000 pound airplane less all the fuel I had burned at this point and with an L/D of six has just about 4000 pounds of drag. Just exactly all I had in thrust.

At this point — and I wish to make my greatest impression on whomever may be interested: "*I had not one single ounce of thrust left to do a thing with.* All I could do was hold 160 and an altitude of perhaps a foot or two above the lake bed." The next act — that of raising the landing gear — pulled me out of the hole. I must admit, however, that I had many more advantages than the average jet jockey. I was then and still am in the test flying racket. I had the use of a dry lake bed some 12 miles long. I knew before hand approximately what the distance would be, but not exactly. I figured it could be made and it was — but my neck, for some 10 or 15 seconds, was out a mile!

Now! Let's cool off and talk about some sensible kind of flying.

So the old XF-90 didn't turn out to do so good when summer weather set in. Neither do a whale of a lot of other jet jobs that I have seen grunting to get off with a full load. Name any one of them and you have a "dog" in hot weather, coupled with poor takeoff technique and too short a runway, and you spell "busted aircraft." Just remember this — you're planning a cross-country flight. Perhaps it's only from Willy down Phoenix way to Webb AFB, Texas; or from Albuquerque to Oke City. Wherever you are, you're in Base Ops. It's not too lively, most of the guys are wishing it was 1700 hours so they could break it off and get a cool one at the club. Some poor guy is sweating out a flight plan at the plotting table trying to figure how he can get home in one jump. He's sweating but it isn't from the flight, it's warm in there and all the fans and coolers are in high blower. Boy! Check that old runway temperature. Get a look at the runway length again. Pay a visit to the front desk and ask the guy in charge of the joint for a look at the takeoff performance chart again. Maybe you're flying a T-Bird or an F-86, F-84, or what have you. Remember they all have different takeoff speeds and distances. Some are worse than others, but that doesn't make a bit of difference. They will all make it, providing they have enough excess thrust to accelerate to takeoff speed and there is enough runway distance.

You look at the charts and according to the numbers you can make it with a thousand feet to spare. You are cleared to take the runway and question yourself again. Did you figure right? Did you use the right column—the one without wind? You were in a hurry at the time and anxious to get airborne and enjoy the cool air from your refrigerator.

You're cleared to roll, 100 per cent rpm, exhaust gas temperature normal, oil pressure normal, fuel flow appears a little lower than it did earlier this morning—Natch! It's hot, boy! Release brakes — the old girl starts rolling — you pass the intersection of runways 3 and 210, you have noticed before climbing aboard that it was 3000 feet from the end of your runway. The airspeed indicator reads 90 and not moving up too fast, matter of fact it's awfully slow. You pass the 4000-foot marker, the indicator reads 120; you want to start pulling the nose up but you know that she isn't ready to make like a bird. You haven't even reached the stall speed yet; the 5000-foot marker flashes by and you start to wonder, "What's the matter with this old tub." At 5500 feet you ease back on the stick and the nose comes up to a respectable angle as you watch the airspeed indicator read 150. That's my speed and the old girl becomes airborne. She doesn't seem as perky as she was that morning, but there's a little life left in the old girl, and the 7000-foot marker flashes by. You make a mental note and raise the gear lever. The end of the runway flashes by and then sage brush and boon docks. After a while when you have settled down to the humdrum of your climb, you notice on your knee pad a number "6000+ feet." It was your note on runway distance and by gosh, it took it, but you did it right and that's why you cleared the sage brush.

Now let's look at a couple of illustrations that will show your problems for standard and not-so-standard days. Figure 1 shows how soft your life is when it's cool. With a 10,000-foot runway in front of you and lots of engine thrust over airplane drag, you get a solid .3G acceleration at the start. As your drag increases

FIG. 1

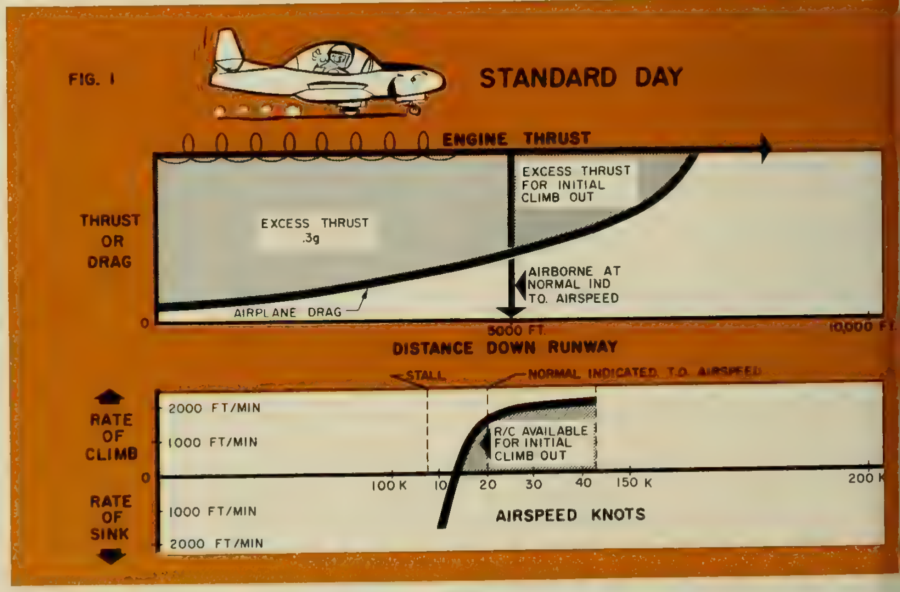
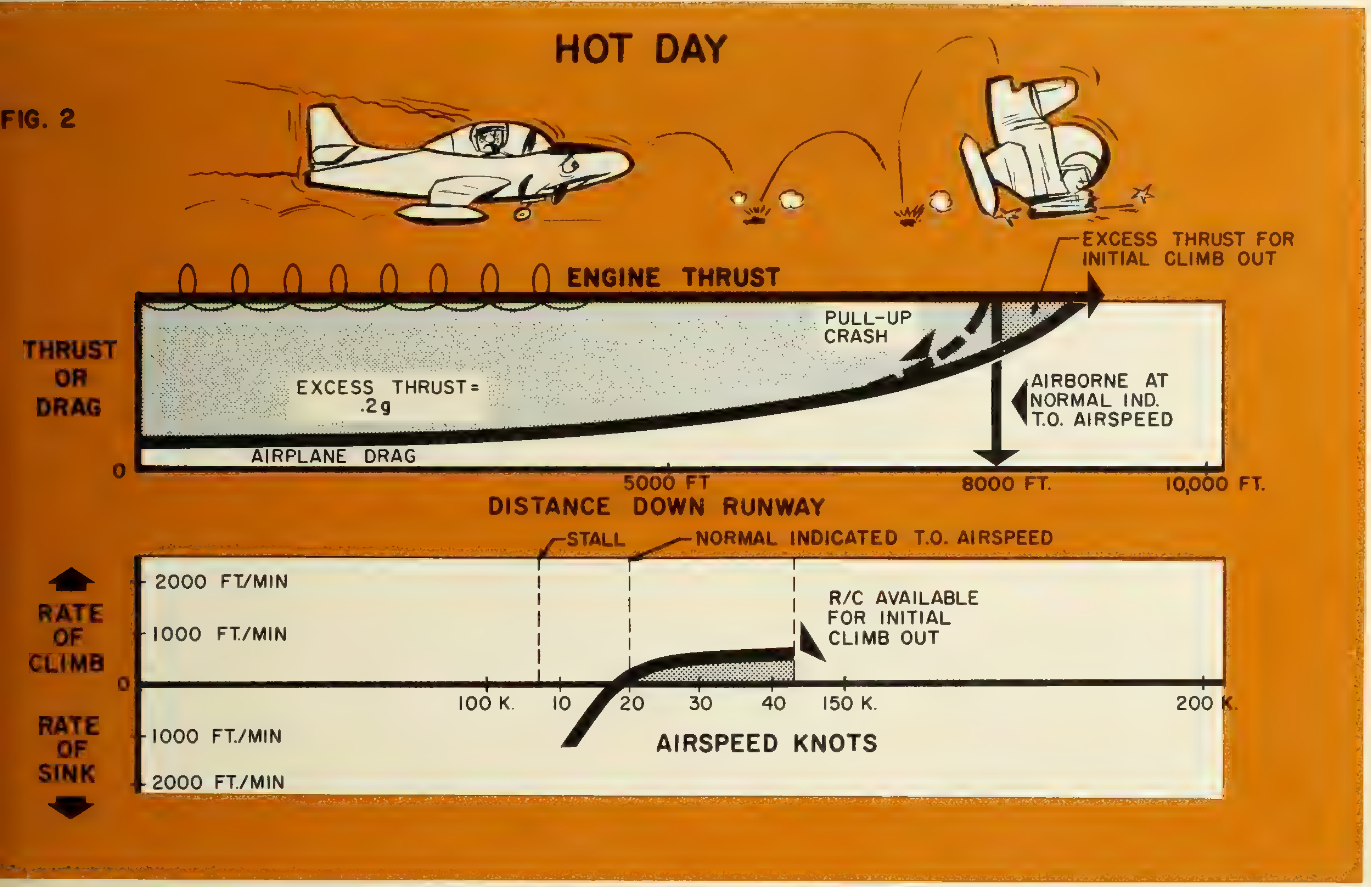

STANDARD DAY

FIG. 2



down the runway to takeoff speed the excess thrust gets less. But notice, it's still real, real good and we have lots of excess for climbout. Now look at your rate of climb shown on the bottom of the chart. See how just above stall you get a good climb and anywhere up to your flap retract speed, things are great. If all days were like this, you'd never have any sweat.

Now, look at Figure 2 for a hot, hot day. The engine thrust is way down and your initial acceleration down the same 10,000-foot runway is only .2G. As the distance flashes by, your speed picks up slowly and by the time you're ready to haul her off you've used up 8000 feet of runway. The excess thrust for climb is a lot smaller now and everything is a heck of a lot stickier. Looking at your rate of climb shows you haven't got much! And you can lose it all by pulling her up the least bit too steep. So you hang on tight, let your speed increase slowly and don't pull the old nose up too much. Look at the difference in the size of those shaded areas of thrust left for climb on the first chart and the one for this hot day. You've hardly got any excess thrust left at all and *it* is only at a narrow speed range. So now that you are all experts and will never have a bit of trouble with hot day takeoffs, here are some helpful rules you can apply in everyday flying.

- Four to five per cent loss in thrust per 10°F. rise in ambient air temperature above sea level standard.
- Two to three per cent loss in thrust per 1000 feet elevation.
- The rated thrust of a jet engine is not your net thrust because of the installation loss.
- The static measured installed thrust is not all available to accelerate with.
- Excess thrust is what is available above what is being used at the moment to hold speed.
- Excess thrust is the thrust that takes the big loss due to high ambient air temperature.

Check these figures and you will see that they come close to your takeoff performance charts.

- For each 10°F. ambient air temperature above sea level standard of 60°F. increase your rolling distance by 10 per cent.
- For each 1000 feet elevation above sea level increase your rolling distance by 10 per cent.
- For clearing obstacles, convert obstacle height in feet to per cent. Add this to the takeoff distance. For example: a 25-foot obstacle increases takeoff distance 25 per cent.

To wrap this all up let me sound off about one more thing. If you keep coming back on the stick before she's ready to fly, you're in real trouble. I know it sounds basic but records show that guys have used up 10,000 feet of runway and 500 feet of sage brush country without ever getting off. They felt that they should have become airborne someplace way back there and kept bringing the nose up higher and higher. Remember that old back-side of the power curve?

So get that takeoff distance down pat, and don't get all "shook" and try to haul her into the air until you KNOW "by the numbers" that she's ready to fly. ●

the Little Drifter

The Coast Guard Cutter COOK INLET, one of the OSVs stationed to help you, the pilot.

APPARENTLY Mr. Webster wasn't familiar with the United States Coast Guard when he defined the word "drifter." However, we can't hold that against him for it wasn't until recently that we realized that drifting is a genuine profession.

We picked up a bit of first hand information on this subject some weeks back when, upon invitation from the Coast Guard, we put to sea aboard the Cutter COOK INLET. In spite of the lack of adequate sea legs, we picked up a lot of information worth passing along. It's all important to you as a pilot, too.

This business of drifting is no gag. It's part of the system of keeping ocean station vessels in an assigned area of responsibility. Like sentry duty, a ship must man its post until properly relieved and that means 21 days "on" at a stretch.

Being in the neighborhood of 1000 miles from land, it is not possible to throw out a hook and just sit fast, nor would it be economically feasible to constantly cruise under power. The compromise then is to stop in the center of an assigned area, shut down and drift. Upon drifting to the edge of the area, fire up and chug back to the center.

The COOK INLET is a 311-foot Cutter, under the command of Commander G. F. Schumacher and manned by slightly over 100 highly trained officers and men. It is one of the 19 ocean station vessels currently assigned to Atlantic waters to man the four ocean stations which are Uncle Sam's responsibility. Day and night the COOK INLET and her sister ships provide radio beacon assistance for guiding our trans-oceanic aircraft and the friendly voices coming from the ocean, far below, always lend a bit of moral support.

Each cutter has a Combat Information Center (CIC) that is manned by radar personnel. They stand ready and willing to render aid, information or any special services that a pilot may require.

A Flight Data Card is filled in by the operator at each contact and maintained in an active file until the aircraft has passed over the next check point. Some of the information contained in this card system includes the type and serial number, of the plane, radio frequency of contact, point of departure and destination, time of departure and ETA, present position, cruising speed, altitude and hours of fuel remaining.

Some of the services that a pilot may request are radar fixes, his ground-speed, true track, winds aloft in the area of the ocean surface vessel, surface weather or conditions at his destination. Such information is immediately supplied.

The OSVs are charged particularly with assisting aircraft in distress. Military or civilian, it makes no difference. Each is accorded all possible help.

We all tend to think, "It can't happen to me," and in some ways that's a good healthy attitude. Nevertheless, we do not leave our preflight planning to luck and by the same token shouldn't assume that we'll never need that helping hand. This then, is how to work with an ocean station vessel if the chips are ever down. If you know their procedures it will aid them in their mission of helping you help yourself.

The problem of assisting a distressed aircraft which finds it necessary to ditch in the vicinity of an OSV is three-fold:

- Effecting a rendezvous between the aircraft and the vessel.
- Assisting the aircraft in ditching.
- Rescuing survivors.

In addition to the foregoing, the problem may be further complicated by other little details such as darkness, poor visibility, lack of ceiling or adverse wind and sea conditions. Somehow it just isn't possible to fly your airplane alongside a vessel, drop it gently into the sea and then say, "Come and get me, please." It isn't possible, that is, unless many variables are fully understood and taken into consideration.

The situations encountered by an ocean station vessel may include one or all of the following:

- Establishing and maintaining communications with the distressed aircraft.
- Advising and alerting other interested agencies.
- Locating and positively identifying the distressed plane.
- Vectoring the aircraft to the surface vessel.
- Advising weather and sea conditions at the ship's position.
- Assisting the aircraft in making a low visibility approach.
- Providing sea lane markers.
- Providing suitable illumination for night ditching.
- Rescuing survivors.

If that sounds like quite a chore, you're right. And, it's only by close coordination between a pilot and the OSV that a successful ditching may be accomplished.

Ordinarily, if you, as an aircraft commander, contact an OSV to report a distress, you will have contacted your ground control station and advised them of the difficulty too. By all means do this, for you want every bit of aid going for you that it is possible to muster.

The ocean station vessel personnel will not assume that you've made shoreside contacts however, and will proceed with an established communications plan to spread the word, thus each contact enhances the rescue possibility.

Experience has shown that once communications are established between a distressed aircraft and an OSV, pilots will hang tight to the original contact frequency, regardless of whether it's an HF, UHF or VHF. One can't be blamed for feeling that way either but, if it's possible to establish contact with more than one radio, so much the better. Once contact is firm, the vessel will immediately describe the steps that are being taken to assist.

If there is any doubt about a distressed aircraft being able to reach the vessel, such as being low on fuel, the OSV will immediately head on an interception course at maximum speed. However, if time is not a critical factor, the ship will start to prepare a sea lane for ditching if conditions require it.

One big problem in this rescue business is the fact that aircraft commanders will, in many cases, be uncertain of their exact position, but will seldom declare themselves lost until they are completely so. Aircraft may be giving positions considerably in error while believing them to be more or less accurate. This, of course, is just asking for unnecessary trouble.

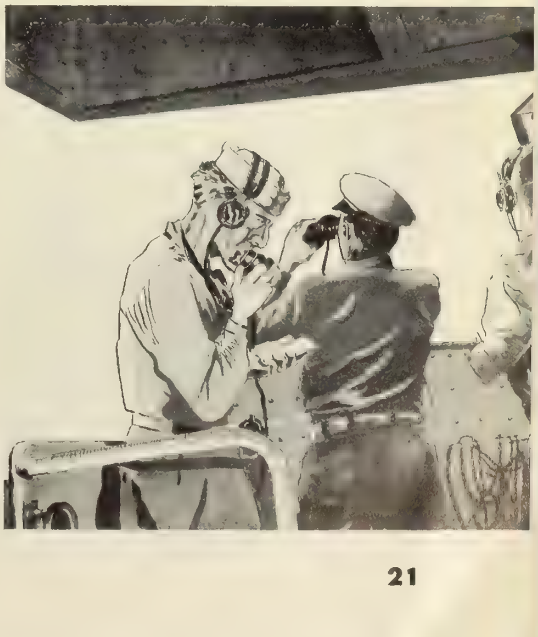
The OSV is prepared to locate a distressed aircraft by one or a combination of the following means:

Radar—provides accurate fix but is limited to an average range of 50-80 miles and has certain limitations because of weather.

Ship's Radio Beacon—The beacon is always readily available and provides homing facilities for aircraft out to about 150 miles, but is sometimes not readable in heavy atmospheric conditions. In case the plane's ADF is inoperative, the beacon is of no use.

Above, Air Plotter calculates aircraft heading as Air Controller, below, works the aircraft.

Below, bridge is kept supplied continuously with the position of the distressed aircraft.



IFF — Can be picked up at ranges greater than a radar target without it.

HF/DF Net—At the earliest possible moment, the shore DF net is alerted. Under favorable conditions, a fair to good fix can be obtained in this manner.

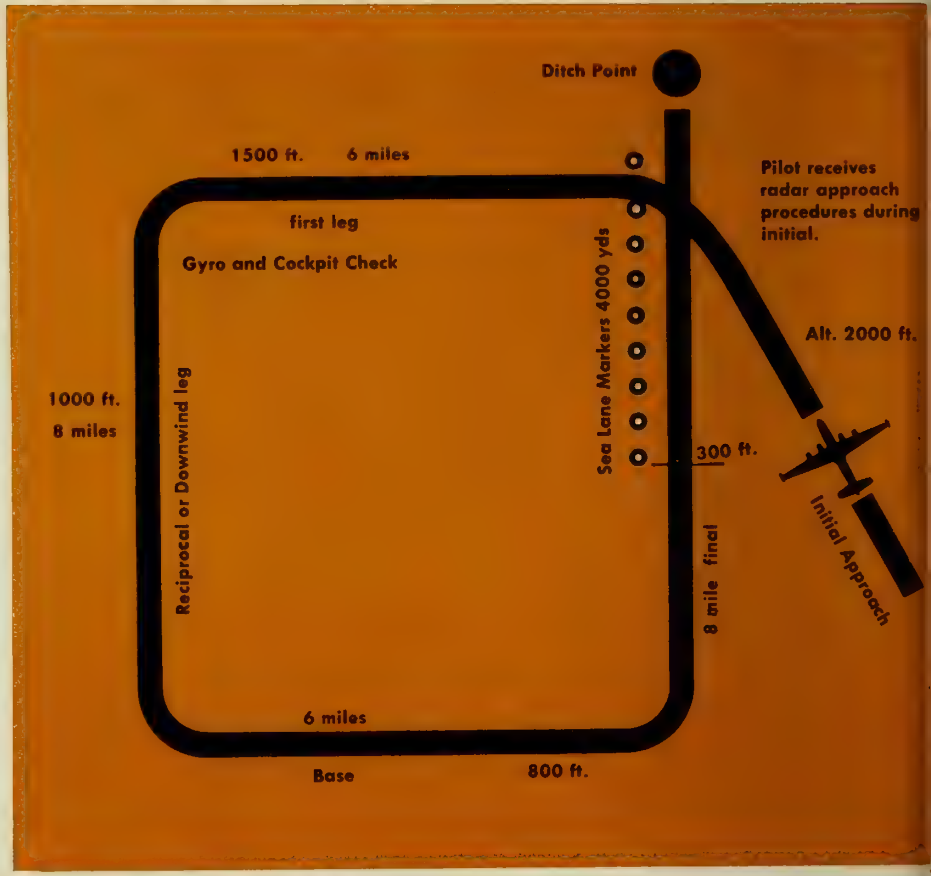
Aircraft's Navigational Data—The navigator may be able to read one LORAN rate (otherwise he might be lost!) and if this is the case the OSV will give the plane a course that will change his reading to that of the ship. When the LORAN readings of the plane and the ship are the same, the bearing of the plane is either the direction of the LORAN line or its reciprocal.

Weather Data—A complete report of weather at the plane's position, plus any unusual weather such as fronts that it has encountered, may be an aid in determining the plane's general position.

Visual Signals — During daylight, the ship will use black smoke, searchlight (blinking) and other means to facilitate sighting. Often the ship will cruise at high speed to create a wake that can be seen from altitude. At night, the OSV will use searchlights, star shells and pyrotechnics.

The preceding methods of location may be used singly or in combination and will vary with the situation. The important thing for the pilot is that he will be located and vectored to the ship, provided he does his part.

Once the general bearing of the aircraft from the ship is known, the pilot will be given magnetic vectors to bring him toward the OSV. Remember, the steers that are given will be magnetic, rather than true. Normally, the pilot will be informed on what basis the vector has been calculated, i.e., by radar, DF bearing, line of position or other.



Rectangular Traffic Pattern.

Practice runs are made to insure that each man is alert and knows his job thoroughly.

With positive contact established, an interchange of information must commence while the pilot is flying inbound. The OSV will give him the ship's position, the ceiling, visibility, type of weather, surface wind, altimeter setting and sea conditions. They, in turn, will want to know if the aircraft can maintain altitude, how many persons are on board (including crew) and remaining fuel in hours. If not already established, the OSV will need all the information relative to the nature of the emergency. They will suggest an alternate radio frequency in the event of a communications failure.

Naturally, a pilot will be most concerned with sea conditions if a ditching appears necessary. Prior to his arrival over the ship, he will be informed as follows:

Direction from which primary swells are coming, their height, speed and distance between crests. Direction from which the secondary swells are approaching, height, speed and distance between crests. The direction from which wind-driven chop is coming and height.

Inasmuch as it is virtually impossible for the average pilot to accurately determine the most feasible direction for a water landing, the OSV will suggest the landing direction if desired and then lay out a sea lane accordingly. Of course the pilot is in charge of his machine and if he disagrees with the suggestions, he can tool off and land any way he so desires. Frankly, we do not particularly recommend the latter course for rather obvious reasons.

Although there are several different approaches which may be used, depending on weather, day or night and other factors, the one that we have found to be the most interesting is known as the *Radar Assist Approach* which to all intent and purpose is a PPI run.

After the aircraft is positively identified, the pilot is vectored toward the ship and told to descend at his discretion so as to be at 2000 feet when over the vessel on initial approach to the pattern.

As he approaches, sea marker dye or float lights are laid out (depending on whether day or night) and the OSV positioned at right angles to the sea lane. Now the first stage is set. A runway has been clearly established.

When over the ship on initial approach, the pilot is vectored on a heading plus or minus 90 degrees to the ditching heading, depending on whether he desires a left or right hand pattern. As he moves out on this first leg of four miles, he is told to descend to 1500 feet.

When four miles out, he is given a 90-degree turn to a course which is the reciprocal to the ditch course and while on this heading is told to descend to 1000 feet. This reciprocal leg is eight miles in length and is in reality the downwind.

On completing this leg, the aircraft is turned another 90 degrees to a heading perpendicular to the ditch course and while on base descends to 800 feet. The base leg is so planned that it intercepts the final at just eight miles out.

As the aircraft is turned onto the ditching heading, the pilot is told to descend, at his own discretion, 100 feet for each mile. In other words, at seven miles the altitude should be 700 feet. At six miles, 600 feet and so on. A constant flow of headings and ranges to touchdown is given. When one mile out he will be told to take over visually as shipboard radar is unreliable after that point.

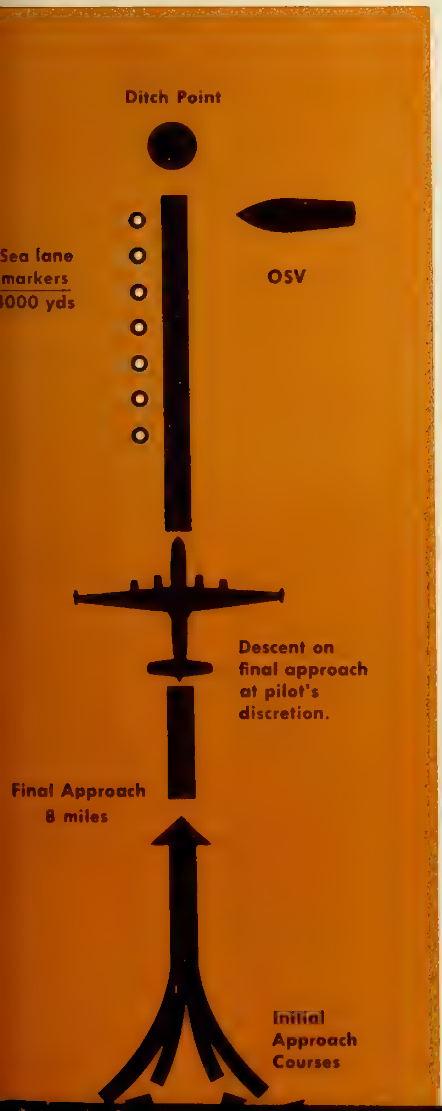
If the aircraft is having difficulty maintaining altitude or control, it may be necessary to eliminate the usual pattern and bring the plane in on a straight-in approach. This is accomplished by bringing the plane onto final approach at eight to 10 miles from the ship. The initial approach is so planned as to intersect the final approach path at this point.

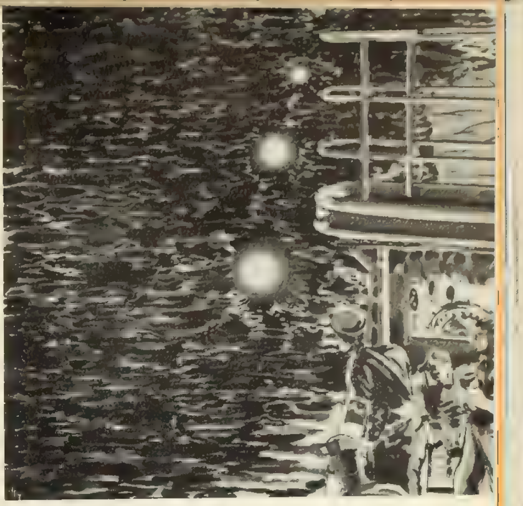
At night, mortar flares are provided over the ditch point, starting when the aircraft is five miles out on final and the vessel is illuminated also. With a lighted sea lane and adequate overhead illumination, the chances of a successful ditching are very high and many have been made without a hitch. You will note from the diagrams that the actual touchdown point is beyond the last open flame light. However, electric float lights are scheduled soon and that may change procedures a bit. By the time an aircraft has reached this point it should be almost on the water, speed reduced to near-stall and the pilot's depth perception will be considerably augmented by the overhead flares.

We reiterate that the pilot must remember that the final 100 feet of altitude, prior to touchdown, must be governed and judged by the driver himself. Radar will continue to monitor insofar as possible but it should be borne in mind that a ditching isn't quite the same as dropping one in on a runway. The height of swells will vary a bit from time to time and banging head-on into a swell is about on par with ramming the side of a ship. If one of those sneakers should rear up just at the flareout, it would be necessary to stretch the glide a bit, no matter how one accomplished it.

Normally, the OSV will lay out a

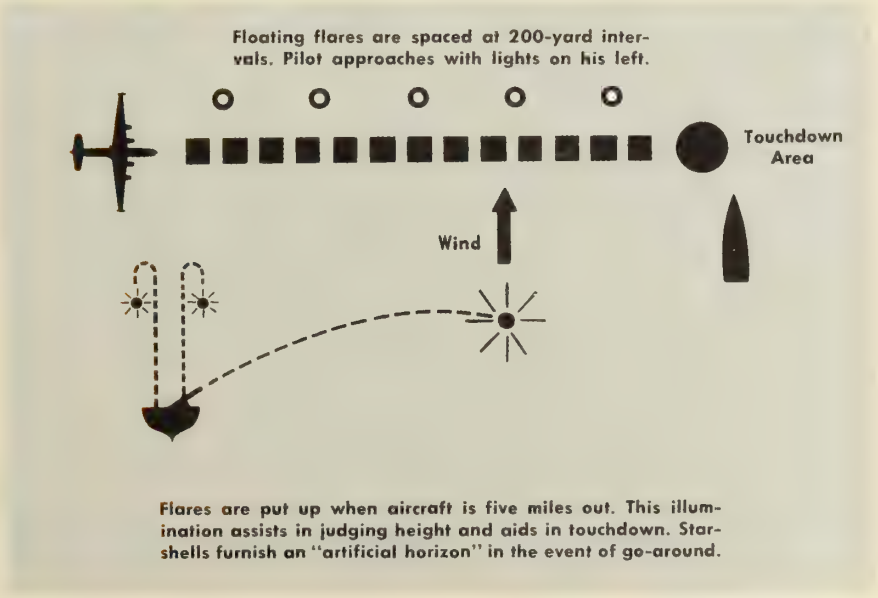
Emergency Straight-In Pattern.





The Executive Officer is responsible for laying out emergency landing sea markers.

Mortar shells illuminate the ditching area.



Floating flares are spaced at 200-yard intervals. Pilot approaches with lights on his left.

Flares are put up when aircraft is five miles out. This illumination assists in judging height and aids in touchdown. Starshells furnish an "artificial horizon" in the event of go-around.

ATLANTIC OCEAN STATIONS (Manned by U. S. Coast Guard)

OCEAN STATION	ASSIGNED RADIO FREQUENCIES (For Details of Use and/or Limitations See Eastern Area ComPlan)				
	Beacon	Route Comms.	Air/Surface Comms.	Ship/Shore Comms.	Emerg./Distress Comms.
(a) BRAVO 56°30'N 51°00'W	391 kc/s	2987 kc/s 5671.5 kc/s	3023.5 kc/s(V) 118.1* Mc/s(V)	Ckt A-3	500 kc/s (CW) 2182 kc/s (V) 8364 kc/s (CW) 121.5 Mc/s (V) 243 Mc/s (V)
(b) COCA 52°45'N 35°30'W	385 kc/s	2987 kc/s 5671.5 kc/s	3023.5 kc/s(V) 118.1* Mc/s(V)	Ckt A-3	500 kc/s (CW) 2182 kc/s (V) 8364 kc/s (CW) 121.5 Mc/s (V) 243 Mc/s (V)
(c) DELTA 44°00'N 41°00'W	350 kc/s	2987 kc/s 5671.5 kc/s	3023.5 kc/s(V) 118.1* Mc/s(V)	Ckt A-1	500 kc/s (CW) 2182 kc/s (V) 8364 kc/s (CW) 121.5 Mc/s (V) 243 Mc/s (V)
(d) ECHO 35°00'N 48°00'W	362 kc/s	5611.5 kc/s 13354.5 kc/s 8947.5 (Alt.) 6567 kc/s	3023.5 kc/s(V) 118.1* Mc/s(V) *To be replaced by 127.9 Mc/s on 1 January 1956	Ckt A-1	500 kc/s (CW) 2182 kc/s (V) 8364 kc/s (CW) 121.5 Mc/s (V) 243 Mc/s (V)

PACIFIC OCEAN STATION VESSELS (Manned by U. S. Coast Guard)

OCEAN STATION	ASSIGNED RADIO FREQUENCIES (For Details of Use and/or Limitations See Western Area ComPlan)				
	ND Beacon	Route Comms.	Air/Surface Comms.	Ship/Shore Comms.	Emerg./Distress Comms.
(a) NECTAR 30°00'N 140°00'W	385 kc/s		5165 kc/s(V) 121.5 Mc/s(V)	Ckt A-4	500 kc/s (CW) 8364 kc/s (CW) 121.5 Mc/s (V) 243 Mc/s (V)
(b) VICTOR 31°00'N 164°00'E	391 kc/s		5165 kc/s(V) 121.5 Mc/s(V)	Ckt A-5	500 kc/s (CW) 8364 kc/s (CW) 121.5 Mc/s (V) 243 Mc/s (V)

Additional Data Included In Supplementary Flight Information Document

sea lane of 2000 yards in length under VFR conditions, whether day or night. Under IFR the length is doubled. It has been found that the longer lane is necessary following an IFR letdown so that the pilot can get himself completely oriented after coming off the clocks.

Of course it would be possible to effect a ditching without a lighted lane but the advantages more than offset the extra time and trouble. The lights provide the pilot with a visual presentation of his heading and aid him in planning the approach. It provides the pilot with an aid to depth perception and is an invaluable help in shifting from instrument to visual flight. In addition, it provides the ship with a reference point for maintaining position.

While aboard the COOK INLET we watched the Combat Information Center in operation during many ditching drills and were extremely interested in the close teamwork and coordination required.

Whether it's a drill or the real thing the evaluator is the sparkplug behind the entire operation. This job is manned by the Executive Officer and he is responsible for laying the sea lane lights, positioning the ship, initiating illumination at the proper time and basically riding herd on the whole show.

The Air Control Officer is responsible for all instructions given to the aircraft and for all decisions relative to headings for the plane to steer. He talks with the aircraft direct. No middle man here.

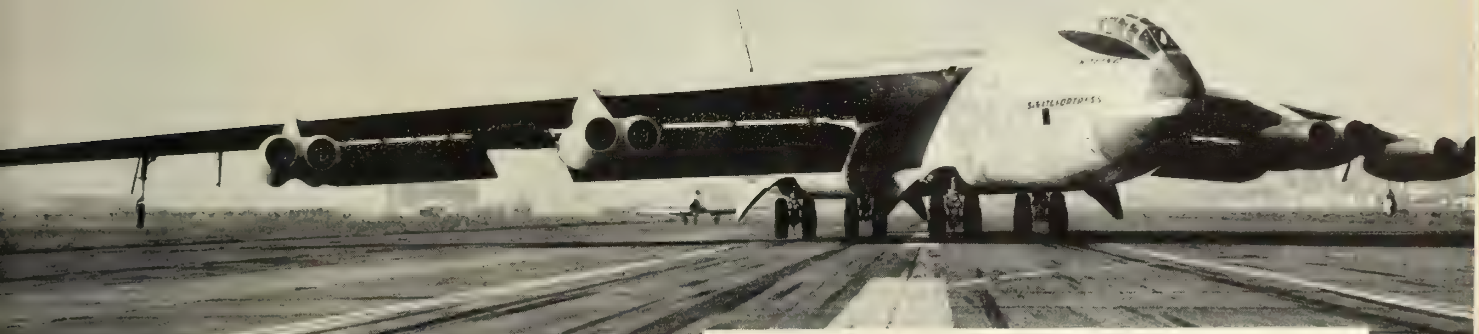
Then there is the Air Plotter, the Air Search Radar Operator and the Surface Search Radar Operator. Together they all work as a team and it is only by a great deal of practice that efficiency is an assured fact.

We sincerely hope that you'll never have to call on one of these little drifting vessels to get you down. As a matter of fact, we hope the same for ourselves, but the fact remains that it's comforting to know that you don't always have to get to land to derive the benefits of GCA—or SCA (Sea Controlled Approach).

The next time you happen to spot any one of our ocean station vessels bouncing around in that vast expanse of sea, just give 'em a tip of the hat. It's a lonely life, and remember, they're out there for us. ●

Keep Current

NEWS AND VIEWS



The crabbing position of the aircraft appears unusual, however, it is characteristic of the cross-wind landing gear of the Stratofortress.

Unique Landing Gear—One of the most unusual features of the B-52 is the cross-wind landing gear installation. This unique landing gear makes it possible for the B-52 to utilize many more existing airfields than would be possible with a standard uni-directional gear. The new gear can be pre-positioned from the cockpit to permit the aircraft to take off or land in a crabbing attitude that cancels out the effect of any cross-wind.

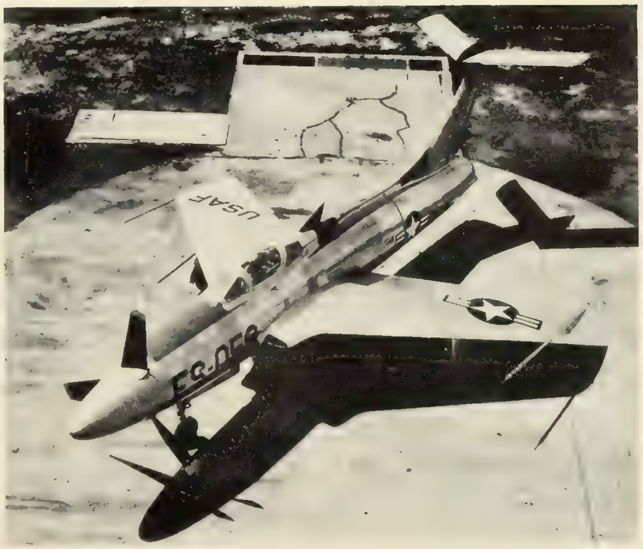
All four of the dual-wheel main-gear units swivel to either side so that the pilot merely has to continue a correct heading for the runway, allowing for whatever cross-wind component exists at the time.

Pilots have already dubbed the device "the pilot's friend." Most of them feel that this is the answer to the cross-wind landing problem.

New Air Traffic Rules—New rules applicable in the Washington, D. C. air traffic zone have been established by the Civil Aeronautics Administration. Without exception, all aircraft must be equipped with two-way radios regardless of weather conditions. Another provision prohibits operations under VFR which assume that the pilot can see and be seen by other pilots, unless ground visibility is at least one mile. In addition, the new rules limit aircraft speeds in the zone to 180 mph, or to the minimum safe speed in cases where a higher speed is required for flight.

The rules are all designed to minimize potential collision hazards, without placing undue restrictions on light planes. The rules will remain in effect until November at which time the results will be evaluated.

The XF-84H—The Republic XF-84H experimental turboprop fighter recently completed its first flight. The 84H is said to be the fastest single-engine propeller-driven aircraft ever built. It can attain even higher speeds when fitted with an afterburner. The economy of fuel permits extensive aerial endurance at altitude and it has the capability of carrying extremely heavy armament loads. The aircraft has wings swept back at a 40-degree angle with air intake ducts in the wing roots.



The Republic XF-84H is a new experimental turbo-prop fighter designed to carry a heavy armament load, get maximum endurance performance.

Helicopter Simulator—A simulator to help train helicopter pilots quickly and safely has been developed by Bell Aircraft. As the pilot moves the controls and flies the helicopter simulator, scenery projected on a panoramic screen changes just as if he actually were in the air.

The equipment is so efficient and the effect so realistic that the student can collide with buildings on the ground and even get airsick. Fuselage vibration is built in, as are engine and rotor noises, rough air and actual control forces.

Winding Up the F

Lyle Monkton, Chief Test Pilot Republic Aviation Corporation.

BEFORE I GET into the meat of "Winding up the F" I would like to clear up a couple of points, real quick-like.

First, when I was assigned to the F-84F spin project I had not spun an aircraft in over four years. I'd merely been boring holes in the blue just like any of you. Oh, maybe I did some testing maneuvers that you may not get around to doing, but all in all I was performing controlled flight maneuvers in the F-84. I bring this up only to impress upon everybody that it doesn't take a special type of expert to spin the "F" and recover, with no sweat. If I can do it, you can do it too. The airplane is soundly designed and as such reacts to spins just like any other good, conventional fighter. If you've checked out in the airplane and possess the required number of arms, legs and heads, the "F" isn't going to give you fits if you happen to end up in a spin.

On the other hand, I'd like to get it straight that I don't advocate going out and spinning this bird just for laughs. This job was made to go fast and carry a load, for tactical purposes. It wasn't built to compete with PTs in a flying circus.

We had one reason for intentionally spinning the 84F and that was to check on the recovery response, just in case some day you find yourself in one of these crazy, earthbound gyrations. Maybe some guys like to spin aircraft just for fun, I don't know. What I do know is that I spin them for only one reason—to see how to stop the darn things.

To start out, let me go on record as saying the F-84F will spin and recover with no nasty little tricks attached. I've performed spins in all types of configurations and under the most extreme conditions. This bird recovers by just following the few rules I will outline here.

I performed all spins in the two-piece tail aircraft because we feel that it is more critical than the slab tail "F". I tested the aircraft clean with forward and aft CG, upright and inverted, and upright with gear, flaps and speed brakes out. I also performed spins with two 230-gallon pylon tanks both full and both empty and with two 450-gallon tanks, also full and empty. All of the spins were started from about 30,000, held for at least five turns and practically all were recovered by 20,000 feet.

Standard entry was with idle RPM, slowing down to about 150 knots with one to two degrees nose-up trim. Although most of my entries were from the level position I did some pulling 2G left and right turns. As soon as the buffet started I would feed in full rudder and back stick and away we'd go. Here a fella has a tendency to get a little "shook" because for the first turn or two the nose will oscillate, that is, come up, then go down. This was more predominant during spins with pylon tanks installed. Even an experienced pilot may feel as if he is in a flat spin, but after the first turn or two the nose does not come up as high and the aircraft settles into a more or less nice, sickly, normal spin.

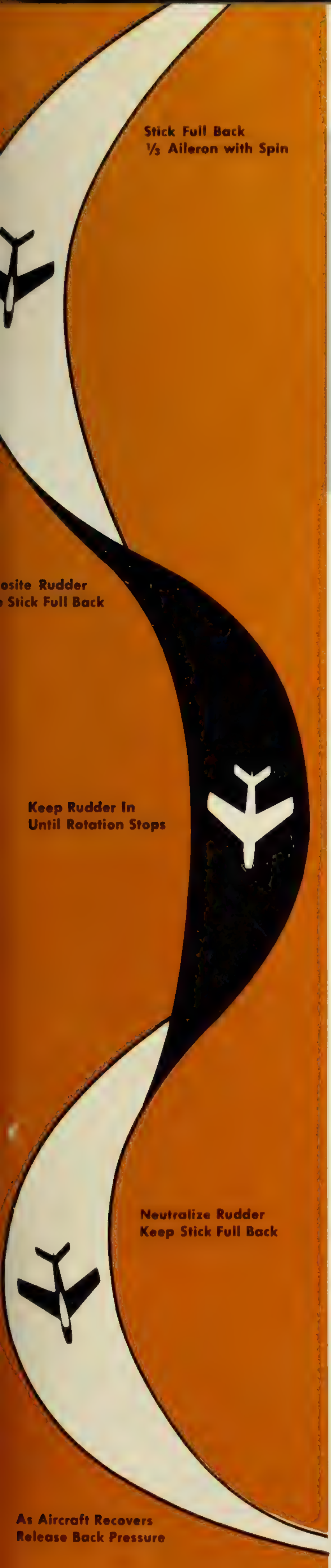
The rate of altitude loss is about 1000 to 1200 feet per turn, which isn't bad at all.

For recovery just feed in opposite rudder and keep that stick full back and slightly with the spin until rotation stops. Don't expect immediate response to the rudder movement. Just bang it in and the airplane will do one to two turns before stopping; then neutralize the rudder. As the airplane starts to recover release the back pressure and fly her out, neat as a bald head.

If you just remember two important things you really will be on top of this spin racket in the 84F. First, you will recover faster if you feed in about one-third aileron, with the rotation during the spin and recovery. I ran plenty of tests with the ailerons every which way and found that this slight amount with the spin resulted in a faster recovery. Now there is a very good reason why I say slight amount and it leads right into the second important thing to remember, and it's real important.

All during the spin, get and keep that stick back in your gut. Keep it there throughout the spin and during your recovery until the aircraft starts to fly out. You will notice that when the rotation stops you will be in a somewhat vertical position and the airplane will start to fly out even with the stick back. So the stick must be eased forward from full back in the subsequent pullout. If you are

Lyle Monkton is Chief Production Test Pilot for Republic Aviation Corporation. He has been performing flight test assignments for Republic since 1951. With over 3000 total hours, and 400 hours in the F-84F, Monkton is the pilot who conducted the spin test program.



premature in the forward stick movement the nose will drop through and you may end up on your back.

In the early part of the program when I was fiddling around with the amount of ailerons to use, I figured if a little is good, a lot is better. So, one bright smoggy day I gave 'er the full aileron treatment with the spin. Now I don't know if you have ever thought about it, but it's not easy to hold full aileron and at the same time keep full back stick. The reason is that your leg is usually occupying that spot in the cockpit, unless you have legs with 90-degree angles in them. As a result I had to ease forward on the stick in order to get full aileron. What happened? — flipped onto my back, into an inverted spin.

This was somewhat discouraging because I was supposed to be conducting an upright spin program at the time, but at least something was learned. That being, *it is all important to keep that stick full back until you are into the pullout stage of recovery*. You can do this and still get about one-third aileron; so that's why we recommend the small amount of aileron with the spin for recovery.

Don't kid yourself about aileron position in a spin. Ailerons against the spin won't slow the rotation. As a matter of fact the airplane spins faster, is more erratic and it just refuses to recover. Even a small amount of ailerons against *prevents* recovery. So, concentrate on getting the stick on the "with" side of neutral. With the ailerons held neutral the reactions to recovery aren't too bad; however, she winds up a lot more and as a result is slower to respond to recovery action. So, by all means, put in about one-third aileron with the spin.

I mentioned getting into the inverted spin phase of our testing somewhat prematurely but it presented no problems. Actually the inverted portions of the tests were the easiest part of the whole program. You really recover fast here because the "F" rudder seems more effective in an inverted spin than in an upright one.

Recovery is a cinch, just opposite rudder, and neutralize the stick. During the accidental inverted spins I got into, I experienced about 3 negative G. That's one way to identify an inverted spin. Your hands and feet have a tendency to pull away from the controls. Something else I might mention is that I know full well that even you old hands sometimes have trouble determining the direction of rotation during an inverted spin. The answer is simple, if the rotation doesn't stop with the left rudder full in for at least two full turns, throw in the right one and out you come.

Like I said, I performed the tests with various types of pylon stores. The recovery technique is the same with or without them. In general, the initial oscillations, rate of descent and loss of altitude are comparable to a clean airplane.

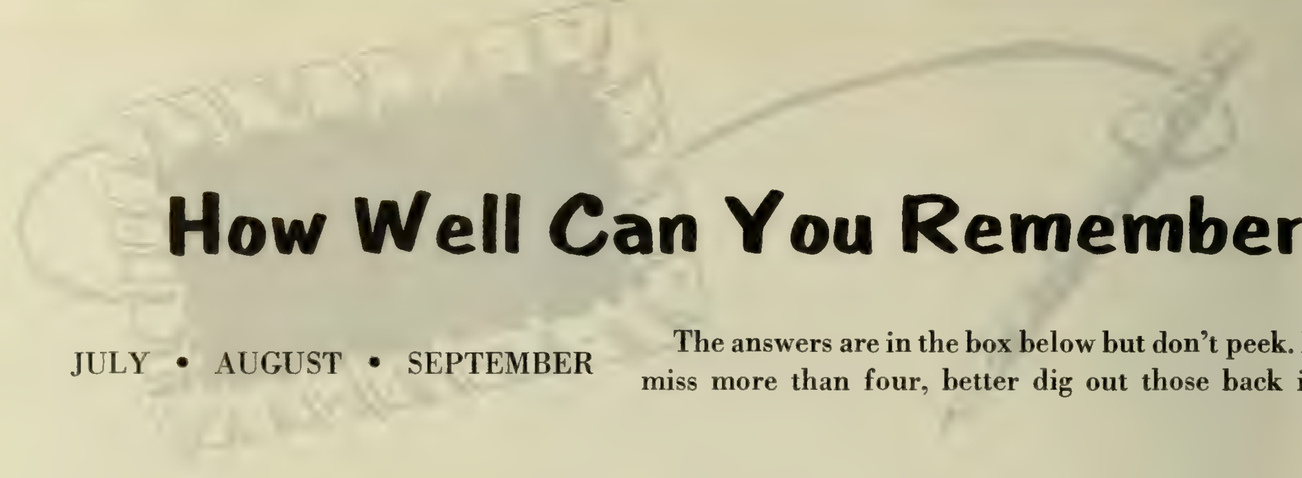
If you happen to be carrying outboard external stores, I recommend getting rid of them. In fact, if the bird doesn't respond to recovery efforts with inboard pylons installed, kick 'em off and try again.

Just for the record I made some one-turn spins in the landing configuration. The airplane was reluctant to stay in the spin when the ailerons were held with the spin. The rotation was very slow. In fact the only way I could get it to really spin was by using ailerons against the rotation. Recovery was normal, ailerons slightly with the spin, stick back and opposite rudder.

All in all, in reading back through other articles on other jet fighter types, it is interesting to note how closely our spin characteristics compare with those of other jet fighters. In the "F", it's just a case of

- Full back stick
- ⅓ aileron with the spin
- Abruptly apply full opposite rudder.

When rotation stops, neutralize rudder and ailerons and when the pullout is well under way ease the stick forward slowly. ●



How Well Can You Remember ?

JULY • AUGUST • SEPTEMBER

The answers are in the box below but don't peek. If you miss more than four, better dig out those back issues.

JULY

1. If your final landing approach is steeper than normal, your airspeed should be:
   - *a. Faster than normal.*
   - *b. About the same.*
   - *c. Slower than normal.*

2. The first F-84F Cockpit Procedure Trainer is located at:
   - *a. Bergstrom AFB.*
   - *b. Luke AFB.*
   - *c. Turner AFB.*

3. During a hurricane evacuation, condition four means:
   - *a. All flight crews take off immediately.*
   - *b. All but essential flight crews take off.*
   - *c. All personnel are alerted.*

4. The Flight Director is commonly referred to as the:
   - *a. Attitude Indicator.*
   - *b. ILAS Indicator.*
   - *c. Zero Reader.*

5. The AN/ARN-14 provides reception of between:
   - *a. 108 to 135.9 kilocycles.*
   - *b. 136 to 236.5 megacycles.*
   - *c. 108 to 135.9 megacycles.*

AUGUST

6. Tests indicate that minimum speed for insuring barrier engagement in the F-86 with 120-gallon pylons installed is:
   - *a. 20 — 25 mph.*
   - *b. 30 — 35 mph.*
   - *c. 45 — 50 mph.*

7. If you lock the left wheel on landing, the aircraft will yaw to the:
   - *a. Right.*
   - *b. Left.*

8. You can create a sonic boom in straight and level flight but it will not be heard on the ground:
   - *a. True.*
   - *b. False.*

9. Information relative to Flight Service boundaries, telephones and interphone facilities are available in the:
   - *a. Pilot's Handbook.*
   - *b. Radio Facilities Chart.*
   - *c. Back of WAC Charts.*

10. The Two Parallel Row approach lighting system results in pilot confusion during low visibility approaches because:
   - *a. Fighter pilots cannot see the center row of lights under the nose of the aircraft.*
   - *b. The approach lights cannot be differentiated from the runway lights.*
   - *c. If a pilot can see only one row of lights he would not know if it was the right or left row.*

SEPTEMBER

11. In operation Gyroscope, each aircraft airlifted______ fully-equipped troopers.
   - *a. 75*
   - *b. 90*
   - *c. 110*

12. A great improvement in analyzing engine instruments in the Boeing 707 is that:
   - *a. All engine instruments are on a consolidated, square panel.*
   - *b. At normal readings all needles are parallel.*
   - *c. When any engine instrument has a reading other than normal, a red light glows.*

13. The Ocean Surface Vessels are not charged specifically with assisting aircraft in distress, but will provide aid whenever practicable.
   - *a. True*
   - *b. False*

14. In jet aircraft the greatest cause for long takeoff rolls due to hot weather is:
   - *a. Loss of engine thrust.*
   - *b. Loss of lift.*

15. To effect spin recovery in the F-84F, hold the ailerons:
   - *a. Neutral.*
   - *b. With the spin.*
   - *c. Against the spin.*

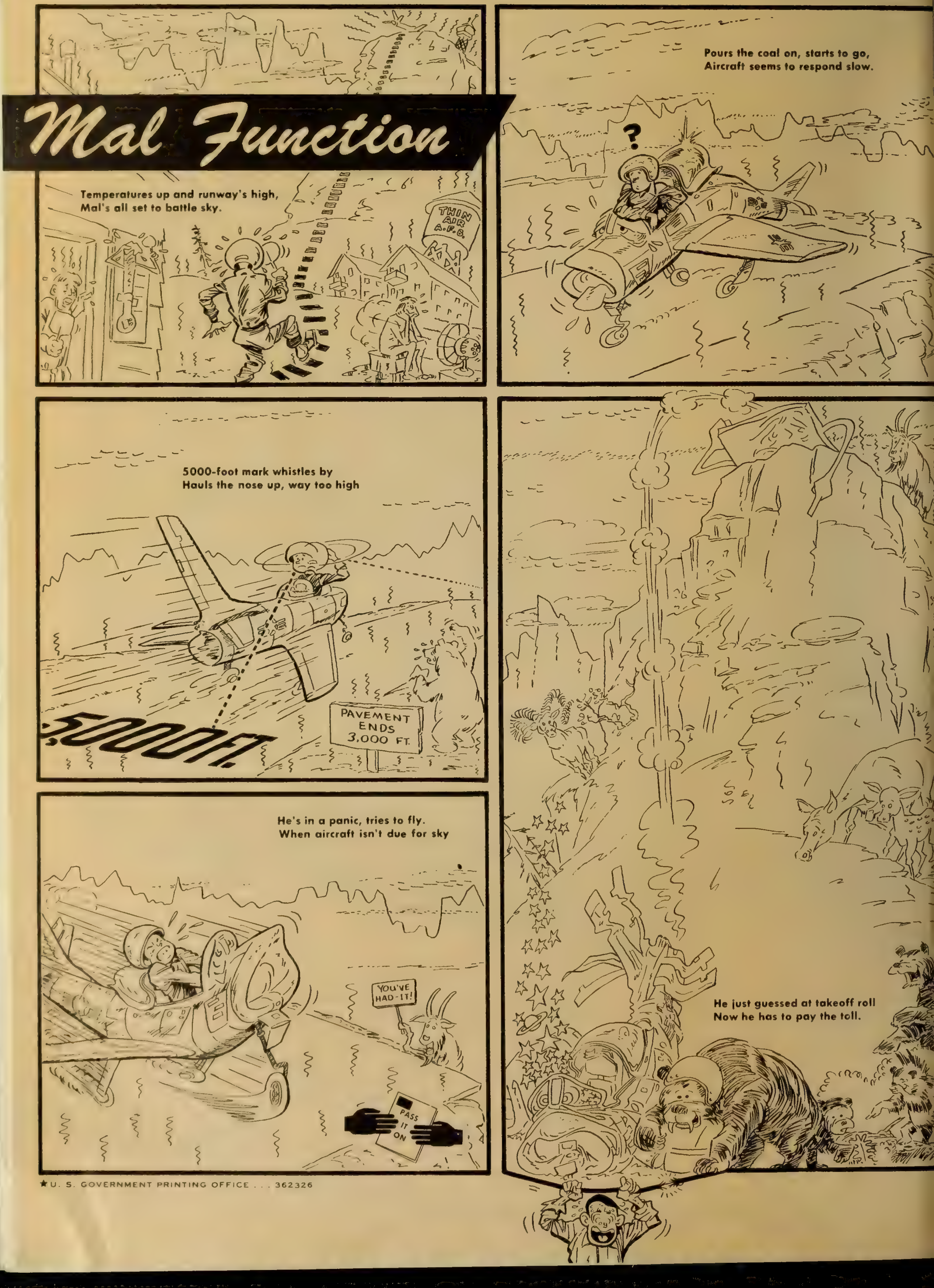
ANSWERS

1. a
2. b
3. c
4. c
5. c
6. c
7. a
8. b
9. b
10. c
11. b
12. b
13. b
14. a
15. b

Play it Cool

Swimming is fun and a good way to cool off. But the big advantage in being able to make like a mermaid is in case you, as a pilot, suddenly have to take an unexpected plunge into the briny. While we're on the subject of unexpected plunges, don't miss "The Little Drifter" on page 20.

Mal Function


Temperatures up and runway's high,
Mal's all set to battle sky.
THIN AIR A.F.B.
Pours the coal on, starts to go,
Aircraft seems to respond slow.
?
5000-foot mark whistles by
Hauls the nose up, way too high
5,000 FT.
PAVEMENT ENDS 3,000 FT.
He's in a panic, tries to fly.
When aircraft isn't due for sky
YOU'VE HAD-IT!
PASS IT ON
He just guessed at takeoff roll
Now he has to pay the toll.

★U. S. GOVERNMENT PRINTING OFFICE . . . 362326

629.1305
FLYS

FLYING SAFETY

UNITED STATES AIR FORCE

OCTOBER 1955

THE LIBRARY OF
OCT 1 5 1955

Special Winter Section

pages 2 to 13

FLYING SAFETY

VOLUME ELEVEN NUMBER TEN

• This month, the book has something for everybody. Pages 2 to 13 are devoted to the Special Winter Section. We've covered cold weather flying from the viewpoint of flying safety, training, equipment and survival, weather tips and a snow removal program. Lots of good poop for all the troops, regardless of what kind of aircraft you are flying.

• As we promised some time ago, we are featuring in the center section of the magazine a special rundown on the new altimeter, complete with pix. This new gage is slated for all USAF aircraft, so best you check this feature closely.

• The story on the back side of the power curve applies to both jet and reciprocal drivers, and the information is a must for all pilots. Also in this issue, Rex is back, we discuss a certain group of Eskimos and a young airman briefs us on survival.

Next month, watch a stand-board at work.

Department of the Air Force
The Inspector General USAF
Major General Howard G. Bunker
Deputy Inspector General

Brigadier General Joseph D. Caldara
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

STAFF

Editor
Major Joseph P. Tracy

Assistant Editor
Major Perry J. Dahl

Managing Editor
Captain John H. Moore, Jr.

Associate Editor
Maj. Jesse F. Townshend

Art Editor
M/Sgt. Steven Hotch

PRODUCTION

Major Ben H. Newby
T/Sgt. Nicholas Shekitka, Jr.

T/Sgt. William H. Johnson
T/Sgt. G. J. Deen
Amelia S. Askew

T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune

CONTENTS

Page

Frigid Flying Safety 2
The Pointer in the Case 14
Hazards Can Be Hidden 16
Snowy Classroom 18
Well Done 19
Sentinels in Mukluks 20
Rex Says 22
Keep Current 25
The Wrong Side of the Curve 26

★ ★ ★

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the abov address. No back copies of the magazine can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in acciden stories are fictitious. No payment can be made for manuscripts submitted for publicatio in the Flying Safety Magazine. Contributions are welcome as are comments and criticism Address all correspondence to Editor, *Flying Safety Magazine,* Deputy Inspector General USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the righ to make any editorial changes in manuscripts which he believes will improve the materia without altering the intended meaning. Air Force organizations may reprint articles fro FLYING SAFETY without further authorization. Non-Air Force organizations must quer the Editor before reprinting, indicating how the material will be used. The contents o this magazine are informational and should not be construed as regulations, Technica Orders or directives unless so stated.

USAF PERIODICAL 62-1

LETTERS TO THE EDITOR

C'mon, Grow Up

The Assistant Superintendent of Jones Beach State Park, Long Island, New York, in a telephone call to this headquarters, has registered a complaint concerning low flying civilian, Air Force, Navy and Air National Guard aircraft in the Jones Beach area. He said that he was unable to identify any of the aircraft by number, but stated that incidents of low flying aircraft were becoming very frequent and that he considered it dangerous for aircraft to fly so close to the crowded beach areas.

It has not been determined that any actual violations of flying regulations have been committed. However, the noise of aircraft flying over the area at low altitudes has proved quite distressing in the show presented nightly in an open air theater.

To expedite action in this matter Headquarters, First Air Force, 26th Air Division and Floyd Bennett NAS were contacted by telephone and advised of the situation. They agreed to put out operational instructions to all subordinate units directing that the Jones Beach area be specifically avoided.

Lt. Col. C. S. Dresser
Hq, CONAC
Mitchell AFB, N. Y.

Seems some guys never grow up. The various service branches spend a lot of loot each year telling John Q. Taxpayer what we are doing with his tax dollar and on improving relations with the civilian populace in general. Then, along comes some "Look No Hands, Louie" character and destroys it all in a brief minute or two.

And of course, this isn't even touching on the dangerous aspects of this kind of caper. At high speeds, or relatively low speeds for that matter, when you get near the ground you're asking for trouble. Whether these boys are in violation or not, someone is going to get hurt . . . let's hope it isn't an innocent bystander on the ground.

We sometimes wish we had a reg with teeth. Not just for chewing purposes, but rather for completely severing a few heads. That might stop the buzzin' business.

★

Denmark Speaks

On behalf of all the pilots in the 729th Fighter Squadron I thank you for your excellent magazine which is studied carefully at our flying safety meetings.

However, we are missing one copy of "Flying Safety", i.e., the one that contains a big article on jet crash barriers. I believe the cover was showing two F-86s taking off with the crash barrier below, and I believe it is from January 1954.

We would appreciate it very much if you could mail us that copy.

2/Lt. Per Alkaersig, RDAF
729th Fighter Sq
Surydstrup AFB
Pr Vojens, Denmark.

FLYING SAFETY thanks the pilots of the 729th Fighter Squadron. The barrier story you mention appeared in the July 1954 issue. A copy is on the way.

★

WAADA Troubles

Many words, written and spoken, have been expended in an effort to keep Air Force pilots aware of the hazards involved in inadvertent opertion in restricted areas. Some pilots still overlook this aspect of good flight planning, but others appear to be leaning toward the opposite extreme by entering "will avoid all danger areas" in the remarks section of the DD-175.

This popular phrase, commonly abbreviated WAADA, can have the same effect as the little boy who cried "Wolf! Wolf!" Flight plans with routes entirely along civil airways or directly through the middle of exceptionally large danger areas are copied every day in Flight Service Centers bearing the remark "WAADA." It is evident that this remark is being entered automatically, with no real consideration of the proposed route.

The pilots, however, are not the only offenders. When a base operations dispatcher was asked recently why the remark was entered on a flight plan along airways, she replied, "We've been entering it on all flight plans near danger areas, to save you the trouble of calling back." *Without the pilot's knowledge!*

This confusion and potential hazard could be alleviated if pilots would file a definite route around a restricted area. Two direct legs, with a turning point near but outside the area is a much neater, more economical method than flying up to the area and then circum-navigating it by pilotage, so often inaccurate in the remote places where restricted areas are found.

There are many advantages in filing this definite route. It fulfills the requirement of Air Force Reg 60-22 which prohibits deviation from the flight planned route by more than five miles during ADIZ operation. In the event of a search, Air Rescue's work is much reduced if the direction taken around a particular danger area is known. In addition, it reflects the pride felt by a pilot in his status as a professional.

1st Lt. David H. Tittle
Hamilton Flight Service Center
Hamilton AFB, Calif.

All the Lt's. points are well taken. But special emphasis should be placed on 60-22. If you are looking for a quick bounce from a fighter type, try it. We know a guy who did. He's real sorry.

Frigid FLYING SAFETY

The Special Winter Section is devoted to many of the problems that crop up yearly for USAF people stationed 'round the world.

EVERY year along about this time, we get out collective heads together and start compiling DOs and DONT's for cold weather flying. As we've said before and undoubtedly will again, this business of writing about winter problems in the middle of August is strictly for the birds, or maybe polar bears. We must admit that it's a bit difficult to keep our editorial minds fastened on ice and snow when the thermometer is pegged in the very high 90s!

About the time this issue of FLYING SAFETY finds its way into your hands, the overall weather will be almost ideal. Fall is the nicest time of year to fly, and it is hard to face the brutal fact that ole man winter is right around the corner.

Getting ourselves operationally, physically and mentally prepared for cold weather is somewhat of a job. However, we've got to remember that, far to the north, weather cells are already forming that will, in time, furnish large chunks of trouble for us.

Winter flight operations cannot be treated with the summerish attitude of "let's go bore holes in the blue." Your machine can take it any time of the year, but you have to be conditioned. As our faithful readers know, we're not particularly statistically minded. Nevertheless, our people who compile statistical data can prove that all too many winter incidents and accidents could have been prevented by a realization that flying conditions, runway conditions and even personal life takes a 180 degree change when the thermometer dips.

For whatever it's worth, you might kick this idea around: Regardless of the type of aircraft you fly and regardless of the mission, the winter season will necessitate an awakening of the mental and physical preparedness of all aircrew members. Winter flying should be broken down into four distinct parts. Flying safety. Training. Personal equipment. And lastly, weather. Add the four together and you'll come up with one basic answer. Let's lead off our Special Winter Section with a realistic approach to flying safety as governed by cold weather rules.

★ ★ ★

PARADOXICALLY, the accident rate during winter months drops. On the face of it, that doesn't seem particularly logical. However, when you consider the fact that fewer flights are made when the snow is blowing, it becomes clear why the rate charts do funny things. But, to jump from rates to reality, the fact remains that we've got to exercise more caution when wintery blasts are about, especially in the field of good flight planning. There's a lot that you should consider before affixing your signature to the Form 175 during those months from October through March.

Perhaps you'll feel that it is a bit

extraneous to keep harping on flight safety, but during the cold months this is one subject that must be stressed in all operational phases of Air Force activities. Strict adherence to the principles advocated and outlined in regs, manuals, directives and even common sense discussions should be a must with every driver in the business.

We've heard the old cry that it's the Base Operations Officer who is charged with the responsibility of furnishing any needed advice and clearing authority. Okay, so that's true, up to a point. We're glad that not too many pilots adopt such an attitude. 'Nuff said.

Cold Weather Plans

By the time this article reaches print, most tactical organizations will have started their respective training programs. Planning for cold weather we call it, and that means concentrating on such essential stuff as short-field landings, emergency procedures and complete operational knowledge of the aircraft systems.

This is just plain know-how about your flying machine. It's surprising to find how fast dust accumulates on carburetor heat controls, anti-icing switches and wind-shield alcohol toggles over a summer.

Most of our readers have been flitting around for lo these many years, and we don't feel it necessary to get into much of the basic treatment on snow, ice, sleet and allied ills. There is, however, one rather touchy subject which is certainly worth a few column inches, namely taxiing and parking.

Slippery surfaces greatly reduce the effectiveness of braking action in steering and stopping. All taxiing should be accomplished with this in mind. In multi-engine craft, judicious use of the throttles is far superior to attempting to use brakes. Any base commander will buy a throttle-turn policy in place of brake turns that often wind up in uncontrollable skids.

Maintenance personnel as well as pilots should remember the three cardinal rules for winter taxiing: First, taxi slowly; second, keep sufficient distance behind other moving aircraft to avoid having snow or water blown back on your machine, and third, do not allow your propeller or jet blast to blow on personnel or aircraft. Anyone who carelessly blasts another plane with a blanket of snow and ice particles is asking for a punch in the eye, and we've got to go along with that.

Skidding, slipping and making like a top on icy runways or taxiways may be interesting for the spectators, but it can get mighty costly. After unceremoniously slamming into a snowbank with an OA-10 years ago, we learned to ignore pride completely and call for a tug when the area is slippery. If we may, we suggest you swallow your pride at crucial moments and do the same.

Bank Perils

Speaking of snowbanks, today in most every organization you'll find at least one driver who will relate, with appropriate gestures, how all that could be seen of the airplane on the runway after landing was the tip of the rudder. It usually goes on from there!

Well, most of us will encounter lesser degrees of piled up snow, but snowbanks call for accuracy and safety, in turns particularly. Make sure that you have sufficient clearance. Be alert when making that preflight runup on slippery surfaces. We've published some rather hairy tales in the past about galloping aircraft that were improperly chocked or improperly managed when the ground was slippery. We'll consider it a personal favor if you'll avoid such pitfalls from here on out.

Probably most of you have read and reread this before, but for the new members may we suggest a few little gimmicks worth remembering in this cold weather business.

Use the old noodle when running up the engines. If there is any loose ice immediately around the plane, remember that it may be picked up by the props and slammed into the wings, flaps, elevators or other vital parts of your aircraft. Pick the runup spot carefully.

After being parked over night, always make a visual check for an accumulation of ice, snow or frost in control hinges or brake shoes. Make certain that the wings, fuselage and empennage are completely free of same.

Every year when we get on this subject, we remember an old buddy who plunked a light plane down on

an ice-covered lake one day, during a nasty snow squall. He learned about clean surfaces the hard way.

After getting the puddle-jumper in the lee of some brush along shore, he and his passenger waited for the squall to pass. And as a matter of fact it didn't take long. About half an hour or so.

When our intrepid aeronaut finally decided to continue the flight, he hauled the putt-putt back onto the ice, fired up and leaped off. Unfortunately, he didn't leap very far. One wing, protected by the brush ashore, was clean of snow. The other panel had about a half-inch accumulation on it.

We were selling airplanes in those days. Luckily this lad was still around to buy a new one. Believe us, he needed it. Probably you know what happened. That snow-covered panel failed to produce any lift. With 50 per cent of the wing working, the results were inevitable. A half roll at minus altitude is hard on insurance.

The moral of all this is simple; make certain that all surfaces are free of ice and snow before attempting a takeoff. Even frost can be more than just a nuisance.

Another wrinkle that should be explored thoroughly is that of cycling the gear after takeoff from wet or slushy runways. Admittedly, there are a few aircraft in which such a procedure would not be allowable. However, in most planes cycling the gear a couple times after becoming airborne will preclude the possibility of arriving at the next destination and finding that the landing gear is frozen UP!

We've mentioned this every year also. Probably always will. Remember the NOTAM file. Those notices get even more important during winter months. On many northern bases, runway and field conditions may change hourly. Last year only a handful of pilots got in trouble by failing to check 'em. We'd like to see that number reduced to zero during the 1955-56 winter period.

Added Load

There's an old saw in the advertising business to the effect that "repetition is reputation." Applied to winter flying, this concerns the formation of ice on aircraft and, it has a reputation. Of course we have anti-icing and de-icing equipment and if used properly it will do a good job. But, for the sake of the record it won't hurt to run through a quick review of the three basic types of ice, how they form, the damage they can do and the preventive measures that must be used to combat them.

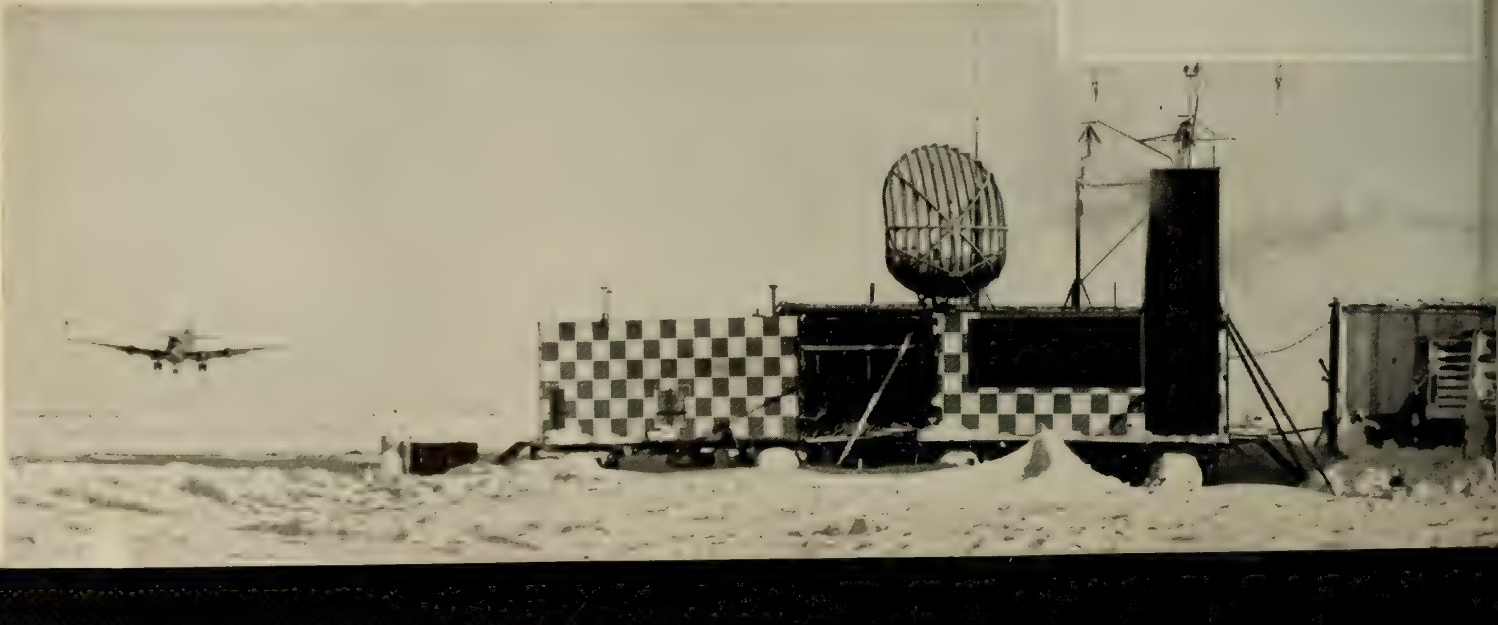
Clear ice is the most serious type and the hardest to cope with. Clear ice forms when supercooled water strikes the plane faster than it freezes. Because all exposed surfaces are wet with an actual excess of water, the ice forms closely to the planes' contour. Such ice will form in areas beyond effective elimination by the de-icing system and eventually will produce a general roughening of wing and empennage surfaces, creating excessive drag.

Cumulus clouds are naturals for clear ice. If you get in a position where you have to fly through an area with cumulus present, prepare yourself for entry and zip on through as smartly as possible.

Rime ice is the porous, white type that is granular in appearance. It forms principally on the leading edges and other minor protuberances. It is more easily removed than clear ice. Judicious use of the boots or anti-icers normally will take care of it. If you have to land with a load of rime on board, remember to maintain a little excess speed on final.

Above, slippery surfaces greatly reduce brake effectiveness. Below, don't carelessly blast other aircraft with a blanket of snow or ice.

"Practice and more practice . . . the reason some IPs have you shoot a GCA after a 10-hour flight."



The third offender is sleet. Fortunately you won't encounter it very often and the best advice for fooling with sleet is to get out of the area as soon as possible.

Jet Engine Icing

For you jet jockeys one must for winter flying is Tech Order 1-1-469. Titled "Operation of Aircraft with Jet Engines Under Icing Conditions," this T.O. should kindle a mental fire. As a matter of fact, understanding it might keep the aircraft flame burning, too.

Briefly, the book says to keep a wary eye on the tailpipe temperature gage. Ice can form on the inlet screens and compressor inlet guide vanes and restrict the flow of inlet air. If you see the temperature jumping up rapidly be prepared to change altitude quickly.

The best recommendation for the pilot of axial flow aircraft is to avoid probable icing conditions by careful flight planning. If actual icing is encountered, change altitude as rapidly as possible or reduce engine power as necessary to prevent excessive tailpipe temperatures.

One general rule to remember under all icing conditions is to climb when encountering all types of ice except sleet. With the latter, one should hold altitude or descend.

Having touched on icing briefly, let's examine a few more variables that enter into winter flying.

Depth perception suffers when the ground is covered with snow. Lack of contrast between the runway and the surrounding terrain may cause the runway to disappear from sight entirely on final approach. Such aids as sea marker dye on the strip or branches of evergreens stuck beside the runway have been tried out with varying degrees of success.

It sometimes helps to have the tower operator turn up the intensity of the runway lights, even in broad daylight. Don't ever get caught short without a pair of sun glasses. On cloudy days the glare is almost as bad as when the sun it out.

DEEP FREEZE TRAINING

KNOWLEDGE itself is of small value without practical application. Even before the snow starts to fall, the really sharp units will have intensive aircrew training programs in effect.

Indoctrination in cold weather operation logically could start with supply. You've got to dress for this business. That Base Ops office is nice and warm on wintery days and so is the cockpit as long as the heaters work. But if things happen to go awry, then clothing is number one on your warmth parade. Don't wait for the thermometer to dip before getting with the personal equipment people. Like the Boy Scouts, let's be prepared NOW!

Thinking along the lines of being prepared, how about your personal proficiency in such matters as basic instrument flying, tracking and letdown and low visibility approaches?

For instance, radio antennas have a habit of icing up. And if that ground speed hasn't been computed constantly, then that section of your anatomy between the head and shoulders may be stretched more than somewhat. Of course there is only one answer to all this. Practice.

Some people say that practice makes perfect. Perhaps that isn't quite true, but did you ever wonder why some IPs will have you shoot a low approach after a 10-hour stint behind the controls? It's the only way we can hope to become and remain even close to perfect.

We speak a bit further along in the book this month about weather. However, a few general points are not amiss right here.

Analysis of weather charts and upper air charts should receive your undivided attention. Most pilots seem to be a trifle more interested in the weather picture during the winter months, and why not? Extreme wind conditions and local peculiarities tend to be magnified more in winter than in summer.

Weathermen, believe it or not, relish the questions aimed at conditions along your projected route. This indicates to them that you are seeking more than just a required briefing. They growl about pilots who take winter weather for granted as much as about pilots who remark that all forecasters bust their forecasts. Remember that many of these guys wear wings too, and they didn't get them any easier than you acquired yours. They are serious about this weather business.

In addition to upgrading pilot proficiency, many commanders get their people together for a series of pre-winter briefings. This is a healthy sort of thing and should be encouraged. It beats the so-called flying safety meetings in every way.

We've sat in on some of the "challenge-me-down" type of get-togethers and they make money. Take a group of pilots and throw in the current Radio Facility Charts, the Supplementary Radio Information booklet and the PHACUS charts and you have the ingredients. Then start off with a question about radio facilities at some given base and off the discussion goes. Besides being informative, it's good training.

Another good gimmick is to get in one of the Air Rescue people and have him go over their mission and how it may affect you.

LIVE IN COOL COMFORT

SIDE BY SIDE with air rescue work is survival. The personal equipment officer and any available survival specialists should be rung in on these pre-winter meetings. It has been proved from operational experience that the chances for survival are directionally proportional to the thoroughness of training received.

There's no denying that an emergency bail-out will prove of little value if the pilot loses his emergency kit before he rests on land, sea or snow. We have many reports that indicate just one solitary knife meant the difference between survival and failure. Most jet drivers and the prop boys know their survival gear and attend regular classes in order to keep current with survival methods.

But it's the administrative pilot who should heed some of the advice passed on by their fellow airmen. Every desk jockey should make himself a handy-dandy kit consisting of a knife, mirror, flashlight and three or four books of matches. Maybe that doesn't sound very impressive, but that little kit might just keep one in pretty fair shape if the chips were suddenly down. Even the old Goonies have been known to falter.

Everyone should read AFM 64-5 again. This is better than poop from the group. It was compiled by guys who really know their business.

Here's another thing you might keep in mind. This deals with moral responsibility, and in this day and age we're getting charged with larger and larger doses of same.

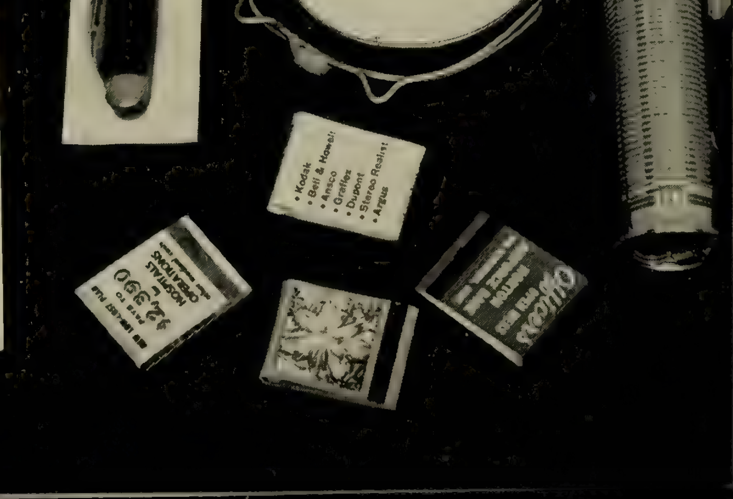
A lot of hours are going to be logged this winter by transient passengers. They have heard the before-flight briefing by crew chiefs, co-pilots and energetic first pilots. Still, every winter troubles crop up and somebody has to pay. Crewmembers must be capable of rendering assistance and leadership to their passengers over and above the perfunctory duty of informing them what a D ring is intended for.

Too little emphasis is leveled in that direction by most pilots. Maybe you've never thought of it this way, but YOU, as aircraft commander, will be the last to leave the great iron bird if trouble develops. If there's any confusion, you can bet it will be too late to make amends. Thorough briefings and insistence on strict air discipline from top to bottom is imperative.

There are a few rules about cold weather operations that should be passed on to all personnel concerned: Keep dry, keep clean, take

"... A desk jockey should carry a handy-dandy kit including knife, mirror, flashlight and matches."

Good clothes can make the man, or rather save him, if he happens to go down somewhere in the Artic.



• Kodak • Bell & Howell • Ansco • Graflex • Dupont • Stereo Realist • Argus

sufficient clothing along, avoid chilling, avoid windblasts, avoid constriction of circulation, wear proper socks, shoes and gloves, dress in light layers rather than single heavy stuff and, when airborne, do not ride hot. (Have the flight engineer turn the heaters low. Maintain cabin heat on the cool side.)

Standard aircraft equipment for survival will depend, of course, where and in what region of the world the plane is operating. However, even in Stateside business one ought to have most of the following equipment on board:

- Two emergency hand axes.
- Two fire extinguishers.
- Two aeronautical first aid kits.
- One pyrotechnical pistol.
- Twelve signal flares.
- One ARC-3 Aldis lamp.
- Oxygen masks. (one per crew member.)
- Parachutes. (Be *certain* you are carrying enough.)
- Safety belts. (No kidding. Check 'em. One per each, you know.)

And there you have it. We've only scratched the surface. If this article has made you think, even just a little, then it has been time well spent in its preparation. Winter flying is just like summer flying. It's the pre-planning that takes more time. Don't skimp on that item. It's available.

COLD FACTS ON WINTER WEATHER

RECOGNITION of certain facts about the source regions of our winter weather and the charted trends and movements of weather cells are two very important phases of wintertime operations that every pilot should consider.

Most fly types know by now that winter weather germinates for the United States either in the polar regions or in the tropics. These cells pick up the characteristics of the surface in which they form. Namely, temperature, moisture and stability. From there to eternity, to coin a phrase, this cell is buffeted around the troposphere. In the U. S. they come roaring down from the Aleutians or North Canada complete with snow and cold temperatures. Or again they sneak in the back door from the Gulf of Mexico with low visibilities and fog.

Denizens of the Pacific Northwest usually are the recipients of an mPw air mass cell first, and IFR flight plans begin to clog control centers as clouds stack over the Rockies.

However, they poop out on the eastern side of this barrier and generally good flying conditions exist in the plains area, with little turbulence and unlimited ceilings.

Down Texas way and extending well up into the midlands and the Gulf Coast states, another cell bangs around most of the winter. Maritime tropical air masses begin their invasion with a lot of poor flying weather because of extensive cloudiness which may be cumuliform, stratiform, or both. Poor visibility coupled with heavy precipitation and widespread advection and prefrontal fogs dampens the spirits of even the best Chamber of Commerce man in Texas.

Meanwhile up in the Great Lakes regions, a mass of cPk weather makes itself felt. Cold and dry and unstable it concocts a lot of cumulus clouds with accompanying turbulence.

So the trends have been established and will continue to follow their ingenious pathways through the skies. We thought a quick re-hash would set your mental directional gyro on the crux of matter. Next on the menu are some of the problems you'll encounter this coming season.

No False Fronts Here

Fronts come in assorted sizes and shapes. (However, space will not be devoted to a discussion of Marilyn, Jane or Gina. Maybe later.) The ones we're talking about are cold, warm, stationary and occluded.

We all know what the colors blue, red, alternate blue and red, and purple stand for on weather maps. They indicate something cooking. As can be expected, the weatherman is going to be his artistic self when it comes to dressing up his product. His hodge-podge of solid lines probably could qualify him for a degree from a modern art school. But, he's got the facts, man.

Cold fronts will be whipping up a lather over your base before long. The slopes of cold fronts average from 1:50 to 1:150. Miles that is. In front of one of these "blue northers" you're gonna be gadget gazing, while immediately behind it you'll tangle with some moderate turbulence. The wind component will shift about at right angles, also.

Warm, stationary and occluded fronts have a tendency to clutter up the atmosphere with low ceilings, drizzle, ran showers, and poor visibilities. Those of you with arthritis will feel the moisture. The entire frontal system will be sluggish and will hand out trouble for sometimes a week or more.

Say, friend, how long has it been since you've had fog in the cockpit? We've done a bit of sleuthing around the shop and found out that this cause factor for aircraft accidents is listed as pilot error. Tracing a little bit further, it's amazing to find out that there are many tons of aluminum resting in the salvage yards of airbases all over the world due to this treacherous, insidious element.

Not many moons ago, a lot of C-54's were churning up the air in the corridors of the Berlin Airlift. Europe during the winter isn't conducive to long life for a careless crew. Fog has to be treated with more than kid gloves. I think we all know what causes it. High relative humidity, very light wind and condensation nuclei. Somebody is going to come out with a fog dispenser pretty soon, but don't hold your breath.

Depending upon where you're drawing flying pay this winter, you'll have to deal with either radiation type fog, advection, upslope and maybe some evaporation type. Take it from us, delay that take-off or circumnavigate the area. We say it again, swallow your pride. You'll live longer.

The icing hazard we've mentioned already. Comes the large-size thunderstorm for consideration. Best you check AFM 51-38, Theory of Instrument Flying, for a good rundown on these cantankerous creatures.

We've gone far enough along in this weather section to say something about the weather forecaster. It's our guess that there might be one or two pilots in the Air Force who haven't at one time or another made a disparaging remark about the ability of these much-maligned lads who prognosticate the weather.

Much of the U.S. winter weather comes roaring down over the Canadian Rockies.

Well, we're going to crusade for them on a couple of points. Mind you, now, we reserve the right to kibitz at any time, but we think they've got their problems, too.

You know how to use all of the gages and dials in your flying machine. You know how to use all of your survival gear. But I wonder if you've given any thought on how to use a weather forecaster.

There's a little saying around the weather stations in the Air Force that goes like this, "If you give us five minutes notice for a flight, you'll probably get a nickel's worth of weather." And that is just about what the hurry-to-scurry pilot gets before he leaps into the air.

There are a lot of factors which govern missions and flights. But we'll venture to say that there would be far less accidents this winter if you troops would follow somewhat along this pattern when you deal with your weather doctor.

Wonder how many of you have ever used the phone to get the WX? We mean 24 hours in advance of your flight. Or better yet, a preflight visit to the station will help immeasurably to gear your mental outlook for the job coming up instead of rushing in pell-mell and out again. Next time, give the forecaster a hint of what you will need in advance of take-off time.

Next step is the proper use or sequence of facilities the weather station has to offer. Isn't it amazing how a pilot can leaf through some hourly sequence reports and know the weather, whereas it takes a competent forecaster every working hour to do the job right.

Actually, while the forecaster is busy with another crew or pilot, you usually have time to case the joint yourself. Number one on your list ought to be the constant pressure charts. Answer this question before reading the next paragraph. On which side of a closed low pressure area on the constant pressure chart will you get the worst weather in wintertime in the U.S.?

Whether you know it or not, these charts are one of the best tools that a forecaster has at his disposal. It gives the winds, temperature, moisture and location of fronts aloft. It is effected much less by terrain features than the surface chart.

These constant pressure charts will indicate major weather trends. Any fly type, who takes a serious look at the past performances of the weather on these charts, can interpolate as to the probable direction of their movement. Then when the forecaster begins his tour with you, you're tuned in on his frequency.

Next stop on your weather beat is a matter of personal needs. Icing levels, turbulent areas, winds aloft and matters of like ilk. Mind you, these things are old hat, but the important thing is to get into a regular habit of sequence.

Lastly, hit the landscape job that he accomplishes every six hours with his colored pencils on the surface chart. Now, you are at liberty to leaf through the sequence reports.

Learn to Listen

One big fault that most of us have in a weather station is listening. Far be it from us to have you read Mr. Carnegie's book on winning friends, but here's a tip. Tell the forecaster your mission or flight and then let him talk and you listen. Helped along by your own incisive questions at the conclusion of his pitch, there isn't any reason you shouldn't walk out of the weather adobe with a clear, concise picture of what you can expect in flight.

Once in the air, the services of the weatherman still can be helpful. First off, how many of you knew that Air Weather Service no longer gives the altimeter setting on hourly sequence reports? Yes, they give station pressure, but not the setting. So that means that you have to get it from the tower or a range station.

Another little gimmick that might help you. Guess you know that when you ask the tower operator or controller for weather at the point of intended landing he calls the weather station. What you should do is to ask for the forecast weather also. This alert gets him on the horn personally and his facts might help you make a decision prior to leaving that all important altitude.

Another refreshing item. Who watches your weather while you are enroute? You do. Flight Service used to flight follow, but no more. Once you clear the tower frequency, you are on your own. Things can get really hairy what with static, ice and turbulence all cropping up at the same time.

The single engine jet pilots have a peculiar problem. They are always playing footsie with fuel. When that destination starts to close in and they're ginning over the 30,000-foot high cone and the controller throws a new clearance at them that requires new flight planning, well, being up the creek without a paddle is a mild understatement. About the only way to solve this vexer is to pre-plan for that omnipresent eventuality. A clear cut, clear weather alternate and constant radio checks will normally alleviate the situation.

Know Your Backyard

That familiarity breeds contempt is an old military aphorism that has made the rounds. But relating it to weather brings up an interesting

The weather office has got the information, so why not use it? Don't go leaping off to some field where freeezing rain or heavy snow are forecast or your plane might look like these.

point. Generally the southeastern, southwestern and far western sections of the U. S. have good winter flying weather. The severe flying weather zones are their opposites. So get familiar with your own backyard. When you go a-calling, use the old noodle.

Here's what one base did to acclimate their pilots to winter flying. They knew where most of their winter flying would be done so they constructed a bar graph to show the comparisons. Just for your information; the degree of better than 1,000-foot ceiling and 3-mile visibility frequency of weather for Tucson, Arizona is 99 per cent as compared to Chaumont, France, which had 59 per cent. Washington, D. C. rated 76 per cent, while alongside was Landstuhl, Germany with 51 per cent. McChord Air Force Base, which notedly has some pretty foul weather year-around, was 64 per cent but, Hahn, Germany was the worst of all six reported with a 43 per cent. So you can see winter flying presents some problems everywhere.

P. S. The answer to the closed low pressure area question on the constant pressure chart is normally on the eastern side. ●

MAKE SNOW-GO

JUST A YEAR AGO we sat down and wrote a short discourse on snow removal. We titled it "Hazards by the Ton. At that time we felt there was little to say about the subject not already known by the average pilot. Possibly we were in error, for since then we have received the most comprehensive snow removal plan we've ever had the pleasure to review.

As we said a year ago, thousands of tons of hazardous material will be delivered soon to many Air Force bases. It will arrive by air, unpackaged and at unscheduled intervals during the next few months.

The soft white flakes which comprise this material can be a grave menace. Often, within a matter of hours they become dingy gray snowbanks piled along runway edges and overruns where a hapless pilot may drive into them. Or they melt on the runway surface and turn into slick, rutted ice, a perfect setup for runup and taxi accidents.

One base, however, has worked out an outstanding snow removal plan. We believe it's good enough to pass along. It doesn't require any special equipment. It *does* require some careful organization and planning. We urge that you consider the recommendations incorporated within this article, and do it long before the first snowflakes fall.

Personnel at Presque Isle AFB have always been cognizant of the difficulties of wintertime operation and since the reactivation of that base more than five years ago, much time and effort has been devoted to methods and procedures for presenting clean runways during periods of inclement weather. The results have exceeded all expectations, and Presque Isle AFB can take pride in a job well done.

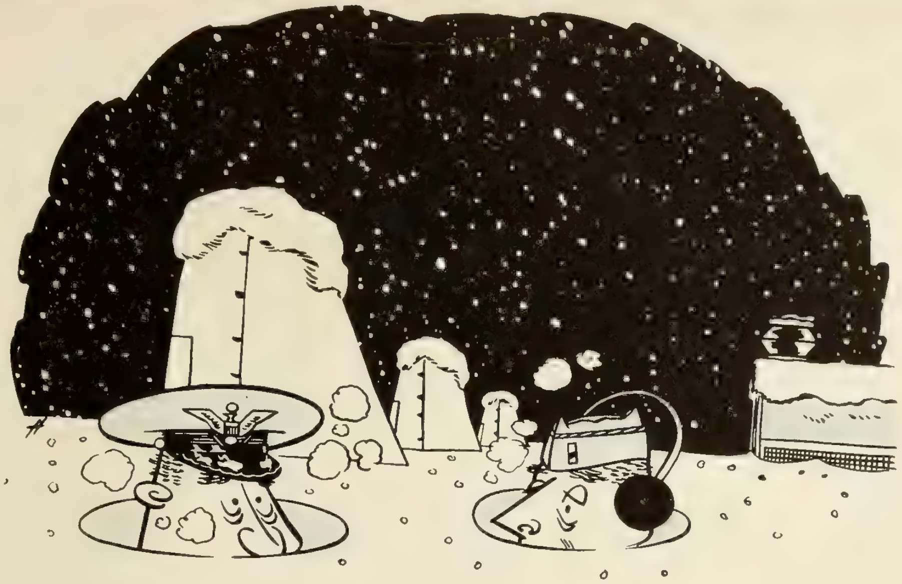
Flying safety occupies an important place in the overall picture of a snow removal plan. Of primary importance is the necessity for providing quick withdrawal of vehicles from the active runway in the event an aircraft desires to land or an active alert mission is scrambled.

We've all heard the plea from FSOs and AIOs that they didn't have any radios for their ground equipment. What would somebody do about it, please? The people at Presque Isle solved that one easily. They have one radio-equipped pickup truck, tuned to tower frequency, that monitors the removal operations and is able to contact all vehicle drivers in a short period of time. This system, in conjunction with light signals from the tower, provides adequate safety precautions.

Another safety factor revolves around the use of a qualified mobile control officer when recovering base aircraft, regardless of pilot experience level and qualifications. It has been proved that during periods of blowing snow and other restrictions to visibility, a qualified person in close proximity to the runway provides the necessary added control needed for good supervision of flying.

Factors contributing to a succeessful snow removal program are:

- SOPs.
- Adequate Equipment.
- Efficient Maintenance Facilities.
- Experienced Operators.



"Suggest you implement our snow removal program when ready, Gridley."

- Proper Control and Supervision.
- Implementation of New Ideas.

Basically, standard operational procedures should be broken down into four phases: Preparation prior to winter; action to be taken upon receiving a storm warning; operation of the equipment during a snowstorm, and lastly, operation of the equipment for snow and ice removal.

There is no magic wand for any of these phases. They must be carefully preplanned, then put into action as required.

As in any military operation, the first requirement for a sustained attack is equipment. In this case, snow removal equipment. It is mandatory that every piece of rolling stock is in good operating condition. Further, it must be ready for immediate use. This means that not only must gas tanks be filled and radiators checked, but batteries must be available on a moment's notice and crews ready to hop in and dig.

Snowplows, including wing-plows, should be mounted on the frames of dump trucks and prime movers. These are for the heavy workloads. Small, straight blades should be mounted on jeeps and tugs for use around hangar ramps and doors.

All equipment should be stored in covered and heated spaces. Cold-soaked engines won't be of much use if it becomes necessary to get on the job on the double. All too often spare parts are overlooked by personnel charged with planning. Even one tired old spark plug can raise particular hob with an operation when machines are teamed.

Of course, one of the most important functions is that of making a complete survey of available manpower to determine how many men are needed for a continuous operation and to insure that operators are well-schooled in the operation of the equipment. It will be necessary to have on hand a complete file on each operator as to address, phone number and how to contact him immediately, when needed. This is especially true of off-base personnel and civilians. The whole organization must be divided into shifts and teams.

Provisions must be made for an adequate amount of sand and salt to be used for ice control. These two items must be stored in a sheltered area and be immediately available. But remember, when using salt in conjunction with wet snow, caution should be observed around aircraft. After each flight, the planes must be washed down.

The AIO and FSO should get together with the Ops Officer and establish a "plan of the base" as to priority for runways, taxiways, parking aprons, roads and other work areas. The prevailing wind, type of storm and other factors must be considered when working from the base plan.

One factor sometimes overlooked is that of assigning a top priority to the issuance of winter clothing for the airmen. A cold worker is of no value to any plan. He simply cannot produce at top level.

Now is the time to get that snow fencing checked and repaired as necessary. Past experience will dictate its placement, but, here again, don't wait until the snow flies to get the fence up. Also, wooden stakes should be fabricated and painted and be readily available for marking of runways. Don't forget that the plow crews have to have a guide.

Okay, so much for the preparation phase. Now we have to consider the action to be taken upon receiving a storm warning. The system of warning must be worked out in conjunction with the base weather officer.

All crews and teams must be alerted and if the warning comes after normal duty hours, civilian personnel must be contacted and transportation dispatched to pick them up, if necessary.

Crews will start up all equipment and make any last minute adjustments that are necessary. All equipment that may be on other jobs, such as road graders, should be called in immediately and checked.

You may not make any dear friends in the food service squadron, but contact them for support in feeding the men if it appears that a sustained operation is in the offing. A hot meal at 0300 hours can work miracles with morale as well as with the physical man, and coffee on a 24-hour basis is a must.

Finally, it will be necessary to hold a briefing of the operators on priorities and weather conditions.

Assuming that the forecast storm arrives, we now enter phase three of the removal program.

As the snow begins to fall, immediate action begins; equipment is readied and prepared for dispatching. When the accumulation of snow is of sufficient depth to warrant the use of plows (usually four to six inches), the snow removal officer will move the equipment out.

The machines employed at Presque Isle AFB are typical of those needed at any field in the same general latitude. Let's see what they use during a typical winter storm.

Four large straight blade plows and two graders are dispatched to the active runway. Two 7½-ton rotary blowers are dispatched to the same runway as soon as the plows have built up a windrow for the blowers to work on.

The designated lead plow starts in the center of the runway, followed by three more large straight blade

plows in echelon, pushing the snow to the right.

After moving down one side of the runway, the formation reverses its direction and moves back up the other side, thus completing one trip. As many trips as necessary are made to build up a windrow about 20 feet inside the runway lights.

At this time, the lead plow leaves the formation and makes one trip just inside of the lights on both sides of the runway. As soon as the lead plow starts its trip, two rotary blowers start to blow the windrows over the lights, clearing them away on both sides of the runway.

In case of a particularly heavy snowfall, the rotary blowers may be used to disperse the windrows on the runway before the straight blades have reached the lights.

The cleaning behind the runway lights is accomplished after it has stopped snowing in the same manner as prescribed for cleaning the runway. A 150 to 200-foot area is cleaned behind the lights and the windrows behind them are removed after the storm is over.

The two graders are utilized during the storm in the center section of the active runway to keep that area as bare as possible. Because of their cutting ability, they can remove the small amount of snow that the larger blades miss.

After the storm has ceased, the graders are used to remove windrows at the intersections and other priority taxiways. One large straight blade plow is dispatched to the alert hangar taxiway and remains in continuous operation in that area. One rotary blower is used in the same area when the plow has made a sufficient windrow to be blown away.

When rotary blowers are working on the shoulders of the runway, the cutting units are not lowered to rest on the ground because of the possibility of hitting a frozen rut or deformation in the ground.

Four straight blade plows and four rotary blowers are dispatched to the priority taxiway. The length of most taxiways makes it necessary to use the four blowers in order to expedite snow removal. One large straight blade is designated as lead plow. The leader starts in the center of the taxiway with the other three large plows following in echelon.

As in the case of the runway, the plows move the snow to the right, travel the entire length of the taxiway, and then reverse direction. Normally, a few trips will open up the area for safe aircraft operation.

Taxiways that have marker lights on them are cleaned in the same manner as the runway. The rotary blowers are used to blow the windrows over the lights, dispersing the snow as far back as possible.

One straight plow and two rotary blowers are used to remove snow around the hangars when the storm abates. Tugs and jeeps mounted with plows are operated by the sections assigned such equipment and coordinate with the large plow crew in removal work around the hangar area.

While these operations are taking place, other crews are dispatched to keep key roads open. Two small ($1\frac{1}{2}$-ton) trucks mounted with sweeper blades and one large plow are sent onto the priority streets.

As soon as the operational runways, taxiways and roads have been cleared, all available equipment is used to clear the overruns for 1000 feet on each end of the runways.

Snowbanks on the taxiways and around the operational areas of the aircraft are held to a minimum of two feet. This is accomplished by use of both plows and rotary blowers. Snowbanks on the runways are eliminated completely if possible.

The accumulation of ice is one of the most serious situations that accompanies winter operations. The use of a road grader equipped with ice blades has been one method of solving the problem. These ice blades are composed of sharp teeth and are attached to the blade of the grader. To utilize these blades efficiently, a 12-ton road grader is required to provide an adequate force to scarify the ice. Where extreme ice conditions exist, crawler type tractors (TD-4s, TD-6s and TD-9s) have been used with some success. The action of the cleats tends to break up heavy ice. The suitability of such vehicles is somewhat questionable, however, because of their detrimental effects on bituminous surfaces and, too, there is a great deal of wear and tear on the vehicles themselves.

A word of warning. Calcium chloride works pretty well in removing ice from roads and highways. A few people have tried it on runways. True, the reaction was all that was expected. The ice melted. But, so did the wings and fuselages of a few hapless aircraft. The corrosive action of calcium chloride on dural is somewhat startling, to say the least.

There is, however, a relatively new product on the market known as Sno-Gon. Preliminary tests indicate that this material is compatible with iron, steel and aluminum. FLYING SAFETY would appreciate hearing from any using organizations after this coming winter has passed. If the results are half as good as indicated by the preliminary tests, we may well have a solution to the problem.

". . . rolling stock must be in good condition."

The spreading of sand on runways and taxiways is one method to insure fairly effective braking action. The sand must be clean, free of lumps and in such condition that it can be spread easily.

Lumps of frozen sand on runways have proved to be a built-in hazard that must not be allowed to exist. It is very probable that major damage to jet engines has been sustained from such malpractice. Experience shows that heated sand is more effective than cold in that it adheres to ice more readily and is not so easily dissipated by propeller and jet blasts.

Weather conditions affect the time

when sand is applied. In the case where freezing rain is forecast, it is sometimes feasible to spread a thin layer of sand before the rain begins. However, if snow follows the freezing rain and accumulates to a depth of over one inch, the sand that was spread will not be effective.

As in any operational plan requiring more than a modicum of skill, the experience level of equipment operators plays a tremendous part in a good snow removal program. The statement that "a piece of equipment is only as good as the operator," is profoundly expressed in snow removal operations. There must be close coordination between the military and civilian personnel and the ability of both to get on the ball at the start of a storm is instrumental in beating the weather. The work of good operators is indicated by the amount of maintenance necessary. A good driver will seldom have his machine deadlined.

Snow removal equipment, used in echelon, disperses windrows piled up by big straight-edge plows.

We spoke earlier of new ideas. Nothing is static. Even such a prosaic subject as snow removal has possibilities of improvement. Let us, then, examine some of the new ideas tried out last winter at Presque Isle.

A disc harrow loaded down to give more bearing force and pulled by a truck was used to scarify the ice on the runways and taxiways. This harrow was successful to some degree but better results could be desired.

Through the installation of radios in key vehicles, the efficiency of the plan was increased greatly. Wasted time and unnecessary dispatching of snowplows was stopped through the use of these facilities.

The use of brooms (towed type) to remove light snow proved successful when the depth of snow did not exceed one-half inch. This type of broom was also used to brush off the ice slush and water during a period of melting. This prevented a further accumulation of ice.

An emergency crew of approximately 20 airmen was set up on a standby basis to shovel out the runway and taxiway lights at times when they were buried from a heavy snowfall. These men would clear an area of four feet in diameter around the lights to allow a snowplow to work without damaging these fixtures.

Using a jet aircraft to remove thin coatings of ice from runways has proved most successful. This is accomplished by inflating the nosewheel landing gear strut, thus directing the exhaust blast onto the runway. *A sweeper must be used in this operation to dispose of the water caused by the melting action.* The aircraft must be in motion constantly or the blasting may sever portions of the runway surface.

With this method of ice removal it is possible to clean a 50-foot strip at one time with an F-89C type aircraft. Naturally, an airplane with a single engine will not clear an area as wide, but should be quite effective nevertheless. This method guarantees a completely bare, dry runway.

Naturally, any base faced with a snow removal problem will plan for the worst and hope. But we strongly urge that snow removal officers keep on the alert for new plans, new methods and new gimmicks. There's usually an easier way of doing any job and quite often, a more efficient way.

Experience has shown that you may expect a certain amount of structural and mechanical difficulties with their equipment. It would be well to be on the lookout for the following:

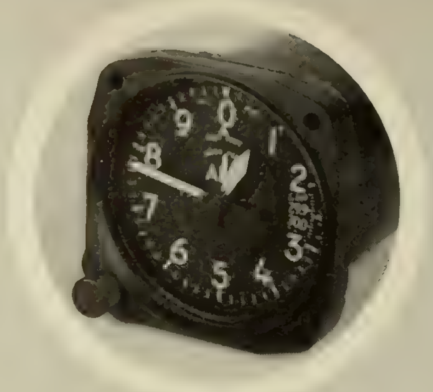
- Electric motors in windshield wipers burn out frequently.
- Mufflers on the rear engines of rotary type blowers cause excessive heating because of back pressure. The solution appears to be in complete removal of the mufflers. However, there is the ever-present danger of carbon monoxide.
- Push frames on 3½ and 5-ton straight blade plows will sometimes buckle. Fish plates or other stiffeners may be the order of the day.
- Cold-soaked engines may be very hard, if not impossible, to start. Getting the rolling stock under cover and preferably in a heated area is a must for efficient operation.

The basic reason for this article is two-fold. First, to point up how a good snow removal plan should operate and second, to give a few of you airplane drivers a small insight into the problems facing any base commander who has a pea patch up in the northern latitudes.

Remember that winter flight planning must encompass a bit of research as to destination runway conditions. The driver who goes tooling around in jet-type machines may well take off in 90-degree temperatures and land in the minus 20 areas.

We'd like to leave you with this thought that so aptly describes cold weather operations. Possibly you'll remember we've said this before:

"Dashing through the snow in a one-horse open sleigh may be a real picnic; driving through it in an airplane is something else again. The snow-removal crews will do everything possible to reduce the hazards of ice and snow on the ground. After that, it's up to the pilot to remember the common sense rules. ●



Experimentation by WADC has led to a new altimeter presentation that makes for quick and easy reading.

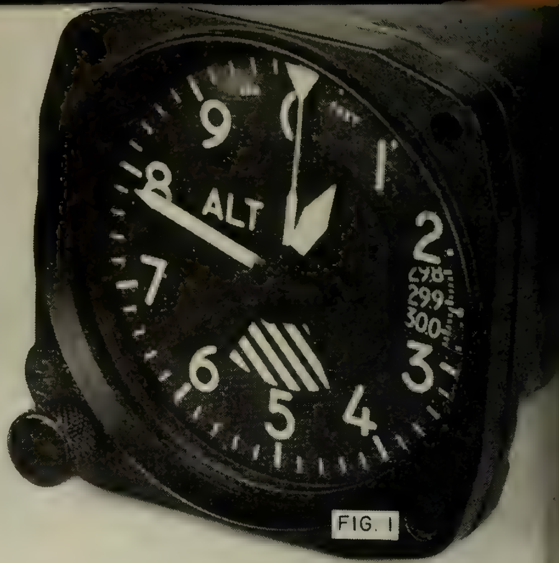


FIG. 1

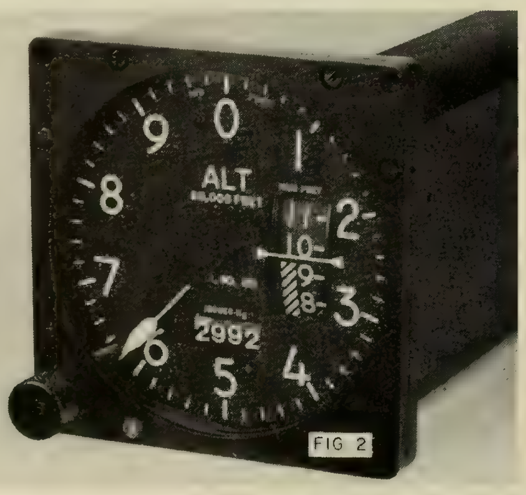


FIG 2

Above, the 10,000-foot pointer provides a conspicuous indication that is always visible. It will tell a pilot, at a fast glance, his approximate altitude.

•

Left, the Drum-Pointer altimeter provides indications of thousands of feet on the drum visible through the vertical window in the right side of the dial.

•

Right, this experimental presentation is a combined altimeter and vertical speed indicator, designed to minimize reading errors and reduce cross check time.

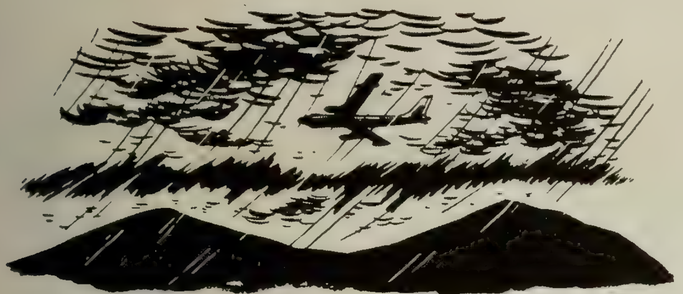
the POINTER in the CASE

As told to Flying Safety by Albert Rosenbaum, Instrument Branch, Flight Control Laboratory, WADC

THE CASE OF the hide and seek 10,000-foot indicator on the instrument that is known to one and all as the altimeter, has been solved. It is satisfying to know that something has been done to improve the readability of the instrument that proved to be the culprit in more than one aircraft accident.

The altimeter problem first reared its ugly head with the advent of high-speed, high-flying aircraft; the ones that crank off feet rapidly by the tens of thousands. At certain altitudes, the 10,000-foot indicator was completely hidden behind one or both of the two larger needles. Often this led to misinterpretation of altitude readings by 10,000 feet. Misreading the altitude by this figure can bring forth dire results. (See FLYING SAFETY, Dec. 1954.)

Fully realizing the situation, WADC set out to develop a better presentation of altitudes. Ten different proposals were tested under actual and simulated instrument conditions, night and day. All of the proposed altimeter displays were designed for ease of incorporation into standard instruments for immediate refitting of present equipment. Results of the tests were conclusive and as a result it was recommended that the altimeter display illustrated in Figure 1 be adopted.



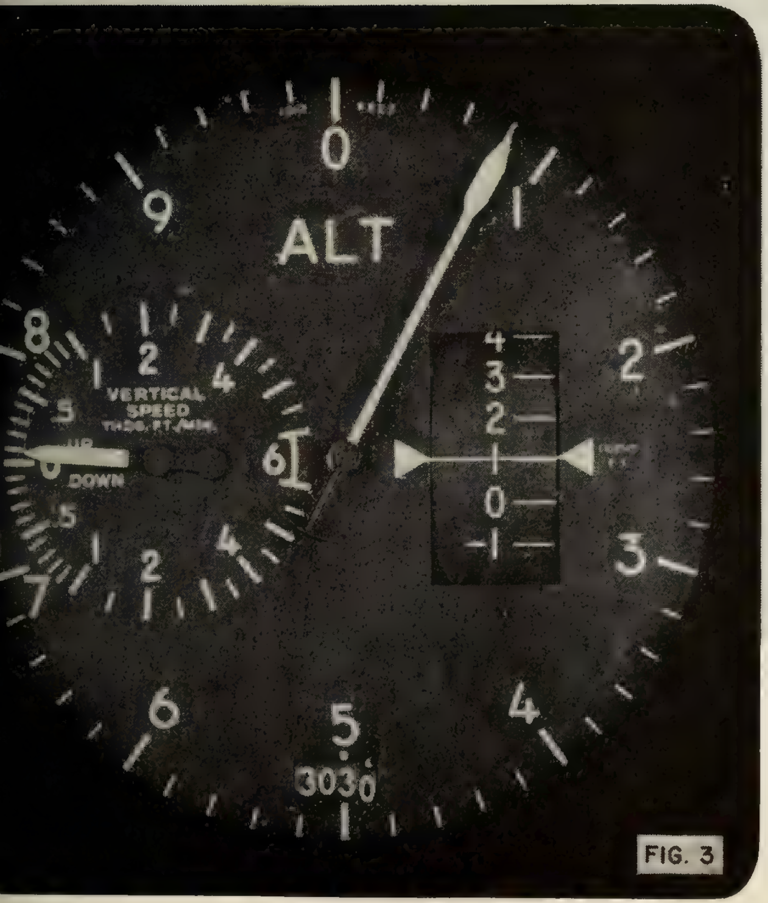


FIG. 3

The large pointer still indicates hundreds of feet and makes one revolution for each 1000 feet of altitude, and an intermediate pointer indicates thousands of feet and makes one revolution for each 10,000 feet. These pointers are just as always. In addition, a small pointer indicating tens of thousands of feet is painted on a black disk with an extension line terminating in a triangular section. This provides a conspicuous indication that is always visible and which can be used to get an approximate altitude at a quick glance.

The other new feature is the 60-degree section marked with alternate diagonal fluorescent and black markings. The striped warning area is visible only between zero and 17,000 feet. When the striped indication comes up on your altimeter, you will know that you are at or below 17,000 feet.

The program is already set up to modify all existing altimeters to incorporate the new display, with jets assigned top priority.

The altimeter just discussed is, in actuality, only an interim measure. Not satisfied with merely doing a bang-up job of establishing this fix, WADC is going ahead with plans to design new instruments that will be as up to date as the aircraft in which they are installed.

One of these is the Drum-Pointer type altimeter. This altimeter is comparable in size and weight to the present one. It provides indications of thousands of feet on a drum visible through a vertical slot in the dial. (See Figure 2.) Indication of hundreds of feet is obtained from a single pointer on the main dial. Also, improved presentation of the barometric pressure scale is accomplished by use of a four digit type counter instead of the window type.

The following warning feature also is incorporated: The diagonally striped markings are included in the thousand feet scale, visible between zero and 10,000 feet.

Tests indicate that use of the Drum-Pointer type altimeter display will materially reduce the incidence of erroneous interpretation by pilots.

Still another experimental presentation (see Figure 3), features a combined altimeter and vertical speed indicator designed to minimize altimeter reading error and to reduce time required to make cross check readings with respect to altitude and rate of climb or descent. The respective instrument mechanisms will still be entirely independent, but will operate from the same static source. The altimeter will provide the indications of thousands of feet on a drum, visible through a vertical slot in the dial. The indication of hundreds of feet will be obtained from a single pointer on the main dial. The spacing of the 1000 feet graduations will be about one-fourth inch, which will result in an easy-to-read scale. The small vertical speed dial also will provide adequate readability.

It will probably be some time before you will see the likes of Figures 2 and 3 around the Air Force. Tests are still being carried on and testing, evaluating and approving an entirely new presentation such as this takes time. But isn't it nice to know that you have people, like those at WADC, who are really interested in doing a job for you . . . the pilot? ●

A small fuel leak can suddenly loom big when you slow to landing pattern speed.

HAZARDS CAN BE HIDDEN

OF COURSE, when the engine instruments start falling off, so does a pilot's sense of security. This is how I felt when I first noticed the fuel pressure gage in the old "Fifty Four" flicker and then drop a few psi. I called my copilot's attention to the loss in fuel pressure and we both affirmed in knowing glances that we were about to lose No. 4. But no, how wrong can you be? My mental gymnastics of shut-down procedure slowed down and then completely disappeared as old No. 4 kept ticking away without so much as a wheeze between revolutions. The gage maintained its low reading with no apparent effect on power so we blamed the indicated loss in pressure on a tired gage. "Remind me to write it up," was my classic remark.

"Land, ho!" boomed our navigator, and there it was, that beautiful strip right under us and we were home once more. Call the tower. Alert the crew. Mentally set up your pattern and then enter it. Power back . . . karoomph . . . dull and sorta muffled but it was there. My side looked okay but . . . "No. 4's on fire!" shouted the copilot, "Real bad, all over. Hit the fire-bottle and get this thing on the ground." I did just that—got her on the ground where what remained of old No. 4 hung on its mounts covered with foamite and char.

Checked and Rechecked

I worked right along with the investigators as far as time permitted. What causes a perfectly good engine to give up the ghost in a blaze of glory (blaze, anyway), after six hours of flawless operation? The board was confronted with this question and I tagged right along with them. I had to know. Some people buy life insurance. I want to know my airplane. Same thing.

Those investigators handled the old beat up engine with kid gloves. You'd have thought it was the latest engine development instead of an almost unrecognizable piece of junk. What was left of it was disassembled part by part and further, each part was checked, piece by piece.

Well, this isn't a yarn on the attributes of investigators but their doggedness paid off. My airborne barbecue pit was fed its liquid briquets from a leak in the engine driven fuel pump by-pass valve. How long had it been leaking? If I had checked the time at the precise moment that the fuel pressure dropped, I could tell you to the minute.

Finding the cause of the fire handed me a mental reprieve. I wanted to be sure that I hadn't goofed someplace along the line and inadvertently caused it myself. Well, I felt pretty good and rather looked forward to meeting the investigating board. I

Flight Handbooks on these aircraft aren't yet revised to include the procedures to be used in the event of fuel pressure drop with the engine operating normally.

Aircraft	*Data now being included or modified	**Data to be included in next revision or next reissue
C-117A & B	X	
YC-122B & C		X
C-124A	X	
B-36J		X
All B-50 series		X
All B-29 series		X
B TB-25J, K & L		X
B-26B & C		X
SA-16A	X	
T-7, T-7C & T-11		X
C-45B & F		X
C-47, C-47A		X
C-47B & D	X	
C-54D, E, G & M	X	
C-74		X
C-82A		X
YC-97		X
C-97A & C	X	
C-97B & D		X
KC-97	X	

* Will be accomplished within 60 days.

** Will be accomplished within 12 months.

was sure that a pat on the back was forthcoming for the way I got her on the ground in one piece. If I left you with the impression that I was surprised when the fire broke out, I don't know what to tell you about the board meeting except, double it. . . .

Facts — Plain Facts

No, there was no malice or hints at my stupidity, just facts . . . plain facts. Although I had no part in the origin of the fire, had I known what I do now, I could have prevented it. So you see, all education does not come from the classroom. I got mine from some friends, so let me pass it on to you on the same basis.

It all stems from this indicated drop in fuel pressure with continued engine performance. When the expected fails to happen (loss of power or erratic engine operation), you and I immediately assume that it's the fuel gage that has failed. So, we tool along and forget the whole thing. Meantime, the gage being in a real healthy condition is trying its best to tell us that although the engine is getting enough fuel to support it in the manner to which it is accustomed, it's not getting it all. The extra three or four psi? Well, it has just found a way out and may be oozing about anywhere in your engine.

Under your normal cruise condition the slipstream is cooling all of the engine parts, dispersing the fuel and things are going along okay. At pattern time it's a different story. When you pull off that power for the gear down slow down, the cooling breeze slows down, too. This completely unbalances its dispersing effect. The three or four-psi dribble finds just the right condition and up in flames it goes. That's exactly what happened to No. 4.

A Believer Now

How could I have prevented the fire? Well, this is what the experts told me, and I'm a believer. If you are still on the ground and the fuel pressure drops below the normal operating limits, but the engine continues to operate normally, stop the aircraft, set the fire extinguisher selector to the affected engine and shut down immediately. DO NOT TAKE OFF. Investigate the cause and have it corrected. During flight if the fuel pressure drops below operating limits but the engine continues to operate normally, the cause may be one or more of the following; primer leakage, oil dilution solenoid leakage, engine driven fuel pump by-pass valve leakage, clogged pressure line, instrument failure or line leakage. In that from where you sit it would be almost impossible to determine the cause, the best thing for you to do is:

- *Cut engine immediately.* Do this if the power is not necessary to sustain flight to reach an airfield.
- *Continue operating engine normally.* This may be done if it can be unquestionably determined that the indicated fuel pressure drop is caused by instrument failure or a clogged pressure line.
- *Keep the affected engine at or above cruising speed while maintaining watch for fire.* This can be done if it cannot be determined whether or not an actual leak exists and the engine is required to sustain flight or maintain the required altitude for arrival at a safe destination.

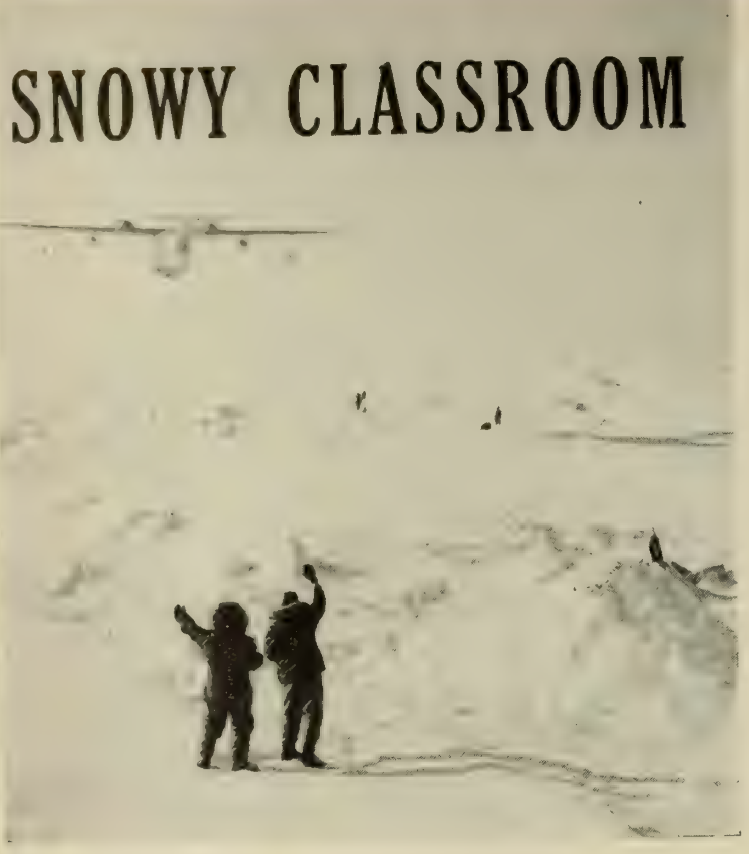
Well, there are your three choices. There's more though. If you do elect to keep the monster in operation, do it like the man says in choice number three. Then, and this is the important part, this is how I could have saved old No. 4. Prior to power reduction for entry into the landing pattern, cut the affected engine completely *by means of the mixture control. Not by retarding the throttle.*

Don't Reduce Airspeed

Unless the added power is absolutely essential to effect a safe landing, do not reduce airspeed until the engine is shut down in the above method. The reduction in speed may be just enough to withdraw the slipstream dispersing effects, and there you are.

Too many pilots have gained a false sense of security as a result of several hours of flight under these circumstances without any indication of fire, then reduced power for a landing and it became too late for corrective action. I know, because I was one of them. ●

SNOWY CLASSROOM



WHEN THEY told me I was going to the last Ice Cap Survival School class of the season at Thule, I wasn't too keen about the idea.

"I've heard about that place," I thought, "and I'll probably freeze to death." But orders were orders, and as an airborne radio operator at BW-1, I didn't have any choice but to go.

Well, shortly thereafter I returned to BW-1. My face was still a little windchapped, but outside of that I survived the school with no sweat.

When we arrived at our farthest northern base, we headed for two days of classroom lectures and movies in the Thule gym. They told us everything we'd need to know on survival. Lectures on Arctic clothing, how to use our equipment, how to substitute for it if we lost it—everything was outlined in full detail.

We all listened carefully, better than we usually do at Air Force lectures, for we knew that in a matter of hours we'd be out on that Cap on our own. There'd be instructors there in case of emergencies, but for the most part it would be up to us to survive.

About 48 hours after we had landed at Thule, we boarded Weasel snow trucks and headed out to the camp site. It was "warm," we were told — temperatures were a little above zero during the day.

The snow truck stopped about 16 miles from the base. The site was covered with snow; not the soft, wet kind they have at Narsarssuak, but a very dry, hard snow. I've never seen any place as still and peaceful.

Instructors told us to go to work building our huts, and to hurry. Seems we couldn't have anything to eat until they were finished. To build one, five of us sawed out blocks of snow and started digging — six feet down. Our only equipment was a trenching tool and a handsaw. After the initial digging, we made a tunnel through the snow and then began carving out our "hut."

Our five-man shelter had four walls of snow. It was big enough for a man to stand up in so we could exercise our muscles and not freeze. I've seen pictures of the Catacombs in Ancient Rome and that's just what it looked like to me. There were shelves in the walls, but instead of coffins like the Catacombs, we had sleeping bags stacked up.

Believe me, I was thirsty. The dry air accounted for this and we weren't surprised, as we had been warned about it. To relieve the thirst we rolled little balls of snow and let them melt in our mouths. *(Ed. note. A bad practice. Doesn't do any good and can cause severe chapping and burning. To get any good from snow, you must melt it.)*

Our first meal was given to us late that evening. That was the best meal I ever ate, even if it was C-rations. I remember we had baked beans—I'd never liked them much before, but they tasted wonderful. To make coffee we melted snow in a C-ration can and heated it over the very small stove from our survival kit. After two hours, it was half-way warm and we drank it — the best coffee I've ever had, too.

During that first night, we had to keep busy talking to keep our minds off the isolation. We heard plenty of noises—foxes—we could tell by the rhythm of their walk. Some guys thought they were polar bears.

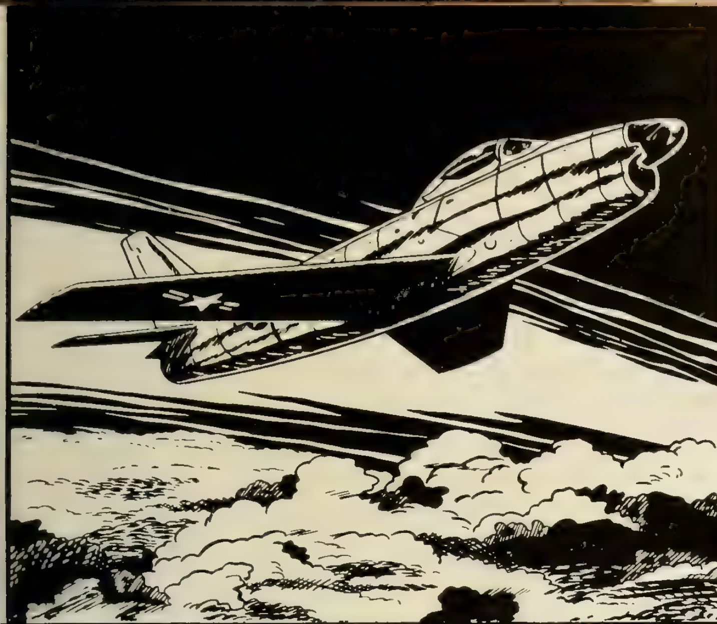
There was one man who was sure it was a polar bear. Now, no polar bears ever roam the Cap, but imagination plays tricks on a man's mind. This boy was so shook up that I had to take him three miles over the snow to the instructors' camp. It wasn't unusual, the instructors said. Even some of the best pilots suffer from hallucinations at times up there.

At night we had to take all our clothing and equipment inside to prevent freezing. Anything left outside would be frozen by morning. I know because I left my gloves out the first night and in the morning they were worthless. From then on I used socks for gloves. Besides taking everything inside, we also had to put it inside our sleeping bags for warmth. It was a funny feeling to turn over at night and have a C-ration can sticking in your ribs.

After the first night, when we tried to go outside, the entrance was frozen solid. The instructors warned us about this, too, but for a minute we were panic stricken. After a few seconds we remembered to crawl back in through the tunnel, get our saws and break the snow. The outdoors looked awfully good again.

During the days, we shot off flares and learned how to avoid being injured when we did. We also made snow signals like the letter "X" which indicates an airplane is downed and unable to proceed. We stained our sign with marker dye and it was so realistic that a C-54, a C-47 and a jet all mistook it for the real McCoy. We were pretty proud of our "X," but we finally had to get rid of it because it was upsetting too many pilots.

Back at Narsarssuak now, I really appreciate this base. It's like Paradise after living out there for a few days. Sure, I didn't want to go to the school and I don't know as I'd want to go again. But I know this much — if the SA-16 I fly in goes down on the Cap someday, my chances of survival are pretty good. And if I hadn't gone to Thule for that survival course, I wouldn't be flying this area with near as much peace of mind. ●



WELL DONE

Maj. Walter P. Meyler

526th Fighter-Interceptor Sq., 86th FIW.

MAJOR WALTER P. MEYLER took off on a local instrument flight in an F-86D, entering an overcast at 9,000 feet. After breaking into the clear at 22,000 feet, the aircraft started to vibrate severely and the aft fire warning light came on. Major Meyler immediately retarded the throttle to IDLE, checked the engine instruments and switched to the alternate fuel system. Although the throttle was advanced, the RPM continued to drop.

Meanwhile, the aircraft had descended into the overcast and the pilot went on the gages. At this time complete electrical failure occurred, causing all flight instruments but the needle-ball, airspeed, altimeter and vertical speed indicator to go out.

Major Meyler noticed in his rear view mirror that most of the fire was bright yellow, indicating a goodly portion was composed of exhaust gases. After weighing all the factors involved, he decided to remain with the aircraft. Rolling out on an approximate heading for the base, he started a high speed descent, using the alternate control system.

He broke out of the overcast at 9,000 feet, about 10 miles from his base. A cockpit recheck was made, the throttle stopcocked and the engine master switch turned off. The fire was now producing some black smoke, but only in a small area. A flameout pattern was set up and mobile control notified the crash crew.

Although the controls were stiffening, Major Meyler made a successful landing and the fire was extinguished quickly. His fine technique and coolness during this emergency saved his aircraft. Well Done.

A vital part of the Alaskan GOC is composed of Eskimo tandem-team observers and even the school children are able to help their parents in aircraft identification.

It's mighty comforting, when flying in Alaska, to know that the friendly eyes of the GOC are following your flight.

SENTINELS in MUKLUKS

Dr. I. E. Chart
Historian, Alaskan Air Command

"Lift up thine eyes!" It might have been the prayer of a 11-man Navy crew as their Neptune limped toward Gambell, located on the tip of St. Lawrence Island. No ordinary circumstance this. Only minutes before, the Kodiak-based P2V on routine patrol in Bering Strait waters, was jumped by a Russian MIG. One sneak pass was enough to clobber the dark-colored bird; a hail of cannon shells tore gaping holes in the fuselage, the left wing blazed in the haze of a still-cold Arctic summer and four men nursed nasty wounds. Maybe the crew was praying; maybe they weren't. But all of them had been in Alaska long enough to know that the watchful eyes of native Ground Observers gave them a better than even chance of surviving.

Aircraft Commander, Lt. R. H. Fischer, USN, just did manage to make it down. His left engine had quit and even with a feathered prop, his prospects seemed dull in the face of a rapidly unwinding altimeter and the burning inferno outside. But he made the soft tundra of an island, four miles short of Gambell.

Yet, in an otherwise desolate region where a cabin is a castle and a bush, a veritable forest, these distressed airmen were not alone. Keen eyes of native Gambellites, who wear the Scout garb of the Alaska National Guard and double up as Ground Observers, spotted the damaged aircraft even before it cushioned in. Taking time only to flash a message back to Ladd AFB in Fairbanks so that the air rescue boys would have time to tool up an SA-16, they hopped into skin boats, wheeled around the island coast and were at the crash scene in less than one hour.

They wrapped it up. No need to embellish the rescue story further, except to say it happened in June.

Alaskan pilots, Air Force, Navy and bush jockeys find this kind of thing mighty comforting. They don't discount the ever-increasing growth of electronic devices to speed them on their way. They know that their own instruments and a solid measure of ground Navaids are pretty good insurance in what occasionally can be termed rough flying conditions in the northland. And there's always ground radar to turn to under emergency conditions. But knowing about those extra pairs of eyes can be very soul-satisfying to a pilot.

Was this an unusual instance? Not particularly, in Alaska. Only a few months before, a native observer — a trapper of sorts, nesting in a remote corner of the Seward Peninsula, spotted the crash of a T-33. Acting on innate ingenuity and calling on his training, he immediately cranked up his radio and reported the disaster to his supervisor, who in turn informed Alaskan Air Command officials through GOC channels. Because of the timeliness and accuracy of the flash, an air rescue unit was able to reach the scene with minimum delay and evacuate the

Inhabitants of sparsely populated villages and lonely cabins are accustomed to function as observers while going about their daily duties. Information on all aircraft sightings is then given to local radio operators.

survivor to Ladd AFB. We have no doubt that this same Londonesque character mushed into the wilderness (It happened in the dead of winter!) and took a hand in proceedings.

Incidents such as these opened up an entirely new role for the 1100 GOC enrollees. By Alaskan Air Command directive, they were officially enrolled in air rescue activities whenever any of the following conditions prevailed; when an aircraft crash or explosion was visually sighted, when an aircraft apparently in distress also was visually sighted or after radio broadcasts had announced an aircraft missing.

Just who are these people who lend a willing hand to the Air Force? How are they organized? What are they up against? Prior to the entry of the Alaskan Civil Defense into the GOC program in August 1953, organized observation posts were nonexistent. Entire native communities, sparsely populated and widely scattered throughout the Territory, were accustomed to perform "the observer role," while inhabitants went about their daily activities. Aircraft sightings were passed to the local radio operator — CAA, Alaska Communications System, Alaska Native Service or frequently a sole resident blessed with outside communications — for transmission to the military air defense system.

At best it was a loose, cumbersome method involving intolerable but understandable delays, one which produced little, if any, beneficial results. But in 1953 AAC and the territorial Civil Defense Organization exerted a concerted drive to pool resources, divide responsibility and build up observation posts in native townships.

To the Air Force fell the tremendous job of establishing a network of posts and training volunteers. And the 10th Air Division at Elmendorf and the 11th at Ladd had only a handful of experts to come up with results. They did it though, even if it meant —50-degree weather, Arctic-style travel by L-20 and dogsled and carrying an Eskimo language handbook in their parkas.

Within two years the GOC was able to boast a strong organization, stretching from the Canadian border to the Bering Sea and from the Arctic Ocean to the Island of Kodiak — which is second to none.

Observers came from all walks of life. Teachers in such tiny communities as Little Diomede Island (a stone's throw from Siberian territory) and Bethel on the picturesque Kuskokwim River, trappers, miners, even roadhouse owners answered the call, no questions asked. We hasten to explain for the benefit of the untutored, roadhouses in Alaska are necessities of life, places where the weary traveler may stop before resuming his long journey.

But the parade of volunteers did not end there. Into the fold marched whole organizations, military and federal, all anxious to lend support. Some day you may receive an Alaskan assignment. If you happen to travel via MSTS vessel, you may not realize it but there are personnel aboard with watchful eyes. They are the Navy's contribution to the system. The Coast Guard operating in Alaskan waters was quick to jump in the swim. Even the hard-working tugs plying between Seattle and Seward offered to "close the back door" in the defense system.

On land it was the same story. Just about every civil agency doing business in Alaska — the Alaska Native Service, the CAA, the Alaska Railroad, the Alaska Communications System, Fish and Wildlife — not only contributed the time of their personnel but extended the full use of their radio facilities, as well.

In a country one-fifth the size of the United States, where native villages occasionally wax nomadic and move from one locale to another, where communications are not merely sparse but subject to severe atmospheric disturbances, we can entertain only an inkling of the problems involved. But it is obvious that the "watchful eyes of the Arctic" are a distinct boon to the northern defense barrier.

It's a chilling and lonely thought to visualize yourself down in a frozen waste, helpless and unseen, where minutes mark the difference between life and death. But now, Alaskan pilots have the comforting assurance that their flights are under constant surveillance, in more ways than one. If anyone does have the misfortune to belly in or pull a ripcord, his chances of getting out unscathed are now much improved, thanks to the members of the Far North GOC. ●

REX SAYS

A BUNCH OF the boys were kicking it around over a few tall ones the other day and, as usual, the talk got around to flying. The subject of hairy deals came up and we decided that one of our Tigers had a sweat job that would be hard to top. So we had him write it up and send it in to old Rex. His description of the incident involving a T-bird follows.

"The flight was normal until I rolled out of my turn on initial. At that point I felt a vibration similar to jet wash, but this figured as there was a flight of four about one mile ahead. But gradually the vibrations increased until I commented to my student that it felt pretty bad for jet wash, and he agreed. As I started to roll into my pitch there were two strange clanks and then a loud bang. I checked the RPM and saw that it was 20 per cent and falling, and that the aft overheat light was on. I retarded the throttle to IDLE, pulled in the speed brake I had just put out a moment before and then, as the RPM was down to 10 per cent, stop-cocked it.

"I turned about 45 degrees to the left and told the tower I had a flameout and would land downwind. They started clearing the pattern.

"When the explosion occurred, there had been a violent pitch-up. I told the student that I thought I had lost the elevators; but then I managed to regain control again.

"The takeoff and land switch was ON and the light was green, and as the fuselage tank was full, I decided to try an airstart. I turned on the airstart switch and put the fuel sequence starting switch in AUTO, but nothing happened. I turned the aileron boost OFF, put the gear down and told the student to actuate the emergency gear system right away.

"I was now on downwind, turning base, and I told the tower that I was landing opposite to the rest of the traffic. There were four ships on the runway and I heard someone tell them to clear to their right, so I lined up on the right side in my direction. I kicked out the speed brake and about this time the student told me that the gear was not down. I checked and saw that the left gear was down, the nose gear indicated UNSAFE and the right gear was still up.

"As I looked up again, I saw that none of the flight of four had cleared the runway. I held the T-Bird off a little and passed over the first and second planes. Both had slowed down, but had made no attempt to clear off. About this time some joker called me and told me to go around as I had no gear. I think I used considerable restraint when I merely told him that I still had no engine.

"The other two aircraft were still coming head-on for me, so I stuck the nose down, bounced on the left gear, getting a three-safe indication, and hopped over the No. 3 plane. He was smoking his brakes, but still heading straight down the runway. The No. 4 plane turned off the runway just as I went by him. After touching down, I pulled in the speed brake, anticipating hitting the landing barrier, but I managed to turn off at the end."

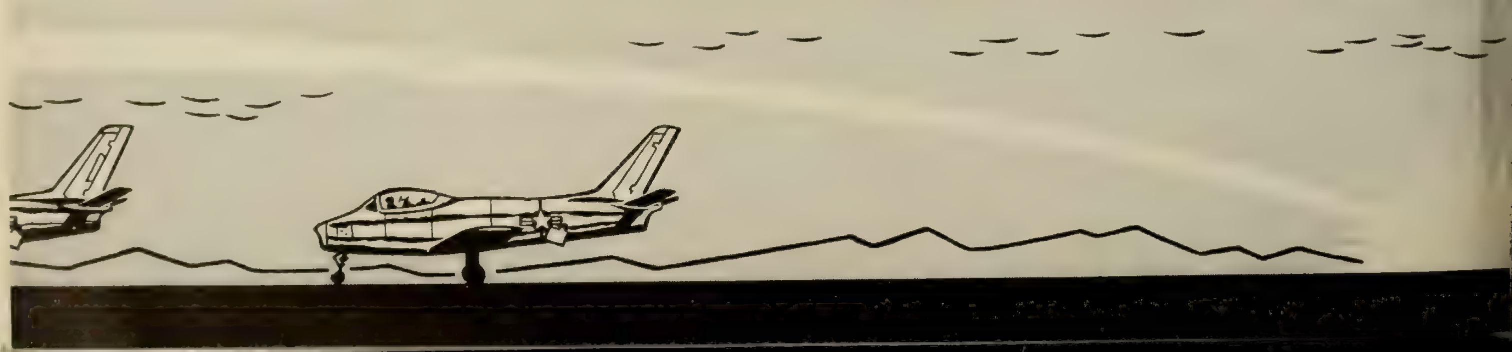
REX SAYS: *That's the first time I ever heard of a Tiger playing leap frog, but it sure was for keeps. This lad did a fine job despite little or no assistance from everyone else concerned. The four drivers coming up the runway in the opposite direction must have been reading books; it is a brass bound cinch they weren't looking outside the cockpit much. As for Mobile Control and the tower, it doesn't sound as if they were straining any vocal cords trying to get the runway cleared for the emergency.*

★ ★ ★

I WOULD LIKE to tell you of an experience I had which may be of some interest to your readers and of importance to all those concerned with safety of flight.

I am a retired, rated Air Force officer. Occasionally, I have taken advantage of the privilege of hitching an air hop, on a space available basis, for which I am most grateful to all of the individuals who make this possible.

At any rate, not too long ago I got a ride to Florida in a C-45. During the trip the pilots changed seats several times so that they could



"... held the T-Bird off and passed over the first two ... bounced and hopped over the No. 3 aircraft."

each get a share of the flying time.

Now this is where my story really begins. I suppose it is part of my psychological makeup, but I sweat out every landing with the pilot. So naturally, I sneaked a look into the cockpit during the landing to see how it was going. We were coming in on a good approach and everything looked rosy, except one thing.

I noticed the red handle on the parking brake was firmly set in the ON position! At first, I tried to rationalize it, saying to myself, "I've been away from flying for a long time and perhaps the brake works opposite from what it used to." I didn't want to display my possible ignorance nor, in my role of a passenger, did I want to infringe upon the rights of the pilots. So I tried to keep my mouth shut. But when we were about one-eighth of a mile from touchdown, at approximately 100 feet, my curiosity finally got the better of me.

In a somewhat hangdog manner I asked the pilot, "Pardon me, sir, but is the brake handle in the correct position?"

He glanced down, and I never saw any one move a control handle as fast as that boy released the brake. It's a good thing, too. The C-45 landing characteristics are such that a landing with the brake on would certainly have washed out the plane, and most likely would have retired me even more permanently than I am.

I thought I would point out this incident as being typical of the little things that can trip a pilot up and cause big accidents. I have noticed also, that on a long trip when pilots change seats frequently they tend to get "cockpititis" and will touch and retouch all the control handles, ostensibly as a check. In this case, one of the pilots must have inadvertently pulled the brake ON and it was overlooked in the pre-landing check.

REX SAYS: *Looks as if you paid up your dues on that save. Those boys must have been super-nervous when it came to touching control handles, though; the brake handle just isn't that accessible on a C-45. Could it be that they just plain weren't as current as they should have been?*

★ ★ ★

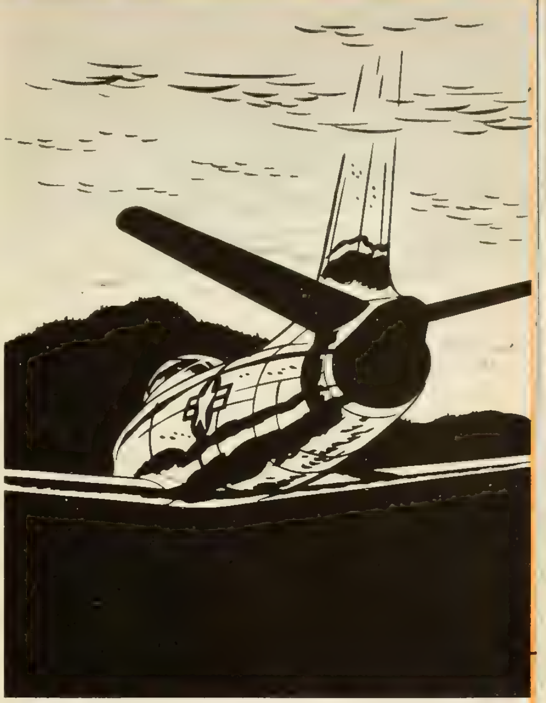
AFTER ONE HOUR of shooting practice intercepts while flying an F-86D under GCI control, I requested a "rackback" to the home field. The weather was 2500 feet. broken to overcast, tops 7500 feet with visibility of five miles.

Having been working with GCI during the period, I assumed that I was still being carried on their scope. I was cleared to descend, and went on the gages after getting a steer to a GCA pick-up point. I broke out at 2700 feet with a large 3500-foot hill staring me in the face!

A rapid pull-up averted a collision, and I then went to my radio compass and scope for directional aid. Climbing back on top, I homed in and executed an ADF letdown without further incident.

Subsequent investigation turned up what had happened. GCI had changed controllers at the time I started my descent and another aircraft was being mistaken for mine.

Actually, I was as much to blame as GCI. Had I metered the birddog and scope, I would have seen that I was not on track and not over the water as I assumed. GCI is a good aid, but this incident taught me that a pilot should use all available navaids when IFR (or VFR for that matter) to avoid becoming part of the landscape.



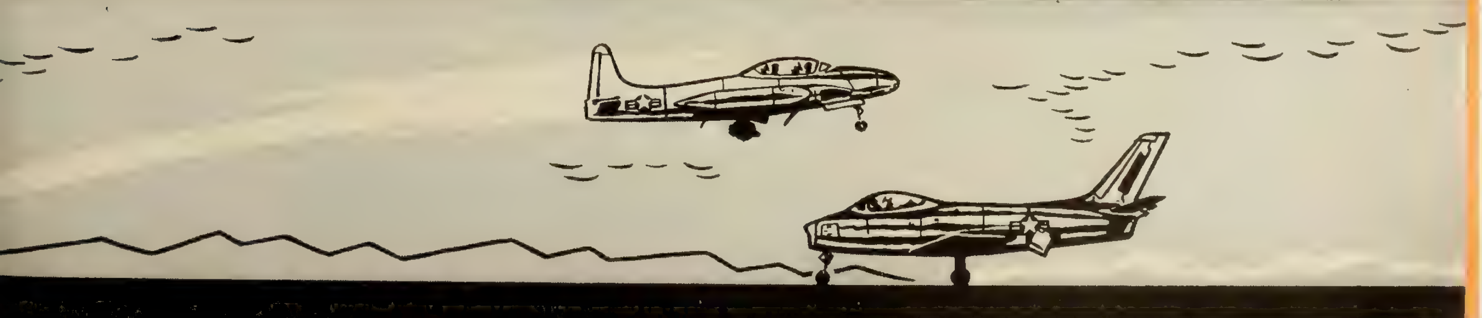
"... then I broke out at about 2700 feet with a large 3500-ft. hill staring me in the face."

REX SAYS: *A thoughtful soul clipped the above narrative out of the FEAF FLYER and sent it in. The pilot's comment about being at fault is especially refreshing, and also plenty true. Any pilot who doesn't use everything he has available just isn't thinking. GCI should have requested a definite identification since they were in the process of changing controllers as the descent started, but it still pays to make doubly sure of where you are when you have the means right in the cockpit*

★ ★ ★

ALONG ABOUT noon on a Saturday early in May, another Captain and I took off on a student training flight. Although we took off separately, we planned to cover the same route.

Prior to our takeoff, while we were planning this flight, we checked the NOTAMS for the base where we planned to RON and found the same NOTAM which we had seen earlier in the week, indicating that it could provide limited parking, limited refueling facilities, limited quarters for airmen and officers and several other qualifications not pertinent to our flight. From previous experience,



Rex Says

these NOTAMS showed no change over last year's conditions. For this reason, we did not hesitate to go there.

We arrived about 1800 hours and were briskly informed that we would be refueled and would have to depart immediately. The Operations Officer advised us that this would be mandatory because of no parking facilities. Also, he let us know that we should have been cognizant of the NOTAM sent out by the base the previous Thursday, indicating that the airport would be closed to transient aircraft for the weekend. I advised the Operations Officer that it would be impossible for me to fly out that night until I had mechanical repairs performed on my aircraft. Further, that if this could not be done I would have to remain until the next day and fly out in the daylight. Then I itemized my aircraft deficiencies to him, which included:

- No slave gyro
- No UHF radio
- No intercom in rear cockpit
- Attitude gyro inoperative
- Rear cockpit magnetic compass bowl one-third full.

None of these discrepancies existed in my aircraft at the time of takeoff for this flight. The Operations Officer advised me he would get the men working on my plane immediately because my plane "just had to get out right away."

During the course of the next three hours, the Ops officer obtained a communications man who was allegedly performing corrective action on my UHF radio. However, he did not sign off the necessary corrective action in the aircraft form. No personnel were available who could perform work on the slave gyro compass. The intercommunications system was still found to be inoperative. I hesitated to consider my UHF radio fully corrected without aerial check, in view of a night flight.

Up to this point, the Operations Officer had continually insisted upon one paramount thing—and that was that I had to get out. When I queried him about the advisability of flying out at night with no slave compass, he made light of this requirement and repeated I would have to fly out or he would have to file a violation on me. I told him finally that I would not fly out in view of the condition of my aircraft and then left the operations building. In the meantime, he had sent the other Captain, whose plane was all right, to another base for the night.

The next morning I sent two messages via Flight Service Wire, requesting this Captain to come back so that I might fly his wing back to home base. After receiving no reply from either wire, I called long distance and persuaded him to do this. After considerable refueling delay caused by inoperative equipment, we were airborne at approximately 1300 hours. Shortly after becoming airborne I verified what I had suspected. My UHF radio equipment was inoperative. I could barely transmit to and receive the Captain on whose wing I was flying. After more delay at our refueling stop, we returned to our home base 20 minutes after the final time for landing at 1800 hours.

I submit this lengthy discussion at the request of the Acting Pilot Training Squadron Operations Officer. I feel that the points of interest to flying safety, other than the mistakes made by myself, are too important to go unnoticed. It was very obvious to me and my student that this Operations Officer wanted only one thing of me, and that was "to get out of the base." I am convinced that he would have signed my Form 175 knowing that my aircraft was absolutely not airworthy for night operation. He insisted upon this avenue of thought right to the end and only upon my refusal to fly did I RON at his station.

***REX SAYS:** Well, now, isn't that a fine deal? I didn't publish the names of the base involved but I'll wager that somebody's ears are burning. The possible serious consequences are so obvious that there is little need for wasting much printing space on them.*

Operations personnel operate in a supervisory capacity to all pilots and this Ops Officer certainly seems unqualified as a supervisor. The Captain used his head in not being conned into taking off at night with his aircraft in that condition.

If a similar situation ever happens to you, I suggest getting the Base Commander in on it. I don't think any commander would appreciate being represented by discourteous, incapable operations people.

★ ★ ★

SOME OF THE boys at our fighter base learned recently that appearances really can be deceiving. They also found out that it isn't such a good idea to make any assumptions about weather; either you know present conditions or you don't.

This incident occurred when a flight of four was practicing formation in the local area. They were flying immediately below an overcast, which was at 14,000 feet. The sun was reflecting weakly through the clouds, giving the impression that overcast was very thin.

A turn was called for by the flight leader, and Numbers 3 and 4 crossed over and above the lead plane. Concentrating on the leader, both aircraft slid up into the overcast. Both pilots rolled out level and informed the flight leader what had happened. No one was very concerned as they all assumed that the overcast was very thin and that they could pop out on the top in a few seconds and rejoin.

As they kept climbing it became obvious that the tops were somewhat higher than they had figured. They finally broke out at 36,000 feet, slightly lost.

The leader finally climbed through the overcast, picked up his two strays and requested a standard jet penetration from ATC. Shortly thereafter, they broke out in the clear, over the station, slightly short on go-juice.

***REX SAYS:** Here we go again. If pilots would abide by their good book, 60-16, incidents like this just wouldn't happen. And don't forget, it's these incidents that start off that chain reaction that ends up as an aircraft accident. Sixty-sixteen says you must maintain 500 feet vertical and 2000 feet horizontal clearance from all clouds. In this case, disregard of this provision could easily have resulted in a couple of flameouts or possible ejections.*

BATTERED BEDRAGGLED and BEAT

FLYING SAFETY is not in the "let's embarrass this guy" business. That's why we have masked off the face of the rather bedraggled pilot whose face appears on this page. Who he is, doesn't matter. What happened to him, does. This is his story. Better check it carefully, there might be a lesson in it for you.

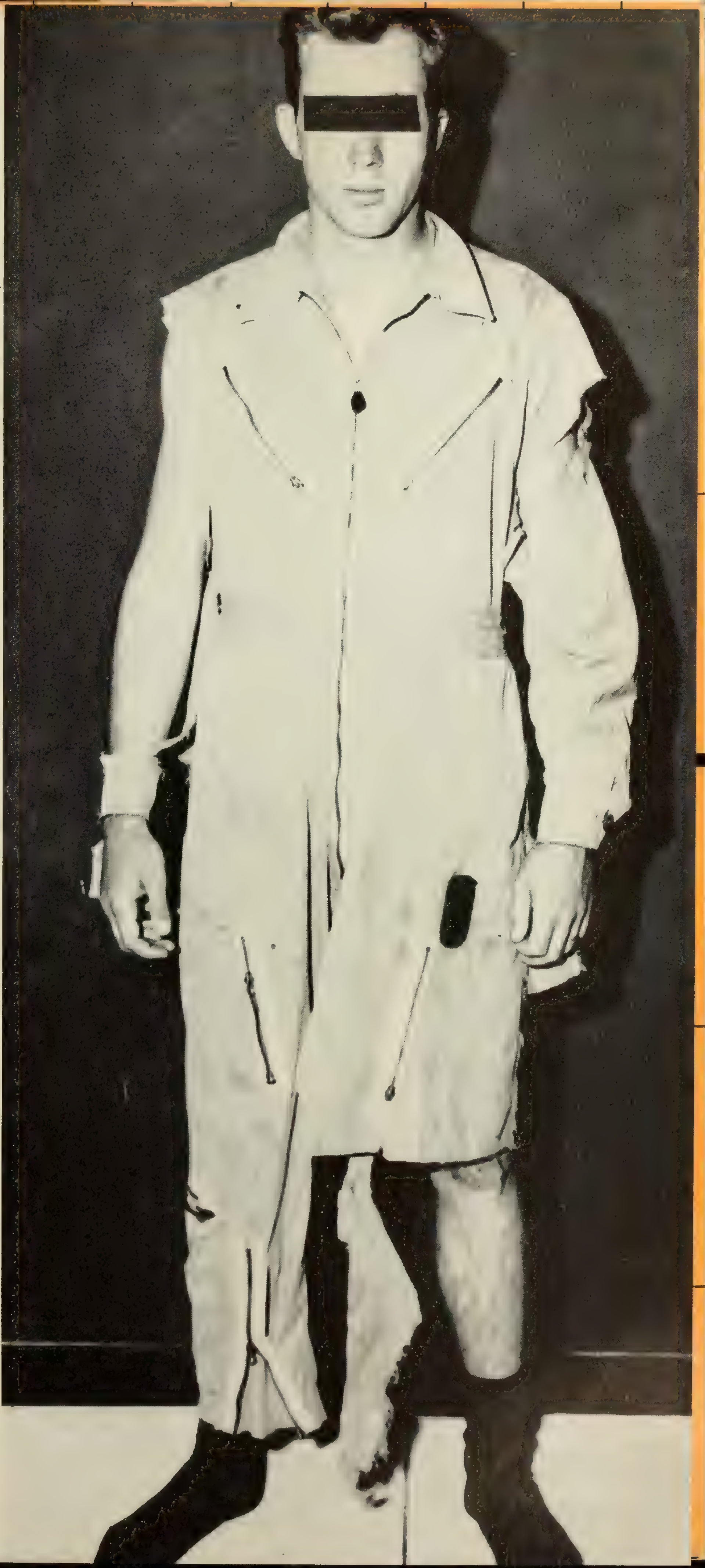
The hairy tale started when our hero was tooling along in an F-86 at 17,000 feet, IAS 350 knots, performing in-trail acrobatics. Faced with a sudden emergency he elected to eject, and did so successfully. However, he has since admitted that he made several mistakes before he ever boarded the aircraft. You be the judge.

He was wearing an old, threadbare WWII flying suit which had several bad tears in it. Force of the slipstream ripped the suit to pieces, as shown in the picture. Fortunately, he ejected in an area where he didn't need the suit as protection from the elements or the terrain.

But this wasn't the only mistake our boy made. He didn't bother to get a chin strap for his helmet. You know what happened. Even though he had his visor properly positioned before jettisoning, he lost everything as soon as he went out.

You may have noted that this lad is in his stocking feet. That's the way he hit the ground. Sans shoes. Seems he had on low-cut oxfords up to and including the time he pulled on the D-ring. After that he had his socks. And he hit in terrain where it was impossible to walk barefooted, or rather sockfooted. Had to tear up his chute and wrap his feet with many layers before he could hobble to a road. He claims his feet will never be the same.

The whole point of this grim little yarn is that it could have been a lot worse under different circumstances. Failure to obtain and use proper personal equipment can get real deadly under many conditions, in any old part of the world. ●



U.S. GOVERNMENT PRINTING OFFICE 362327

629.1305
FLYS

FLYING SAFETY

UNITED STATES AIR FORCE

NOVEMBER 1955

THE LIBRARY OF THE

Charts Have Changed Since the Dark Ages

see page 16

FLYING SAFETY

VOLUME ELEVEN NUMBER ELEVEN

- A good example of safety through standardization is the story on the "Shakedown Artists" starting on page 4.
- A real hair-raiser begins on page 10. An ADIZ violation results in one each "Dog in the Drink."
- The Aeronautical Chart and Information Center prepared an article on maps and charts which tells what charts are available, along with the requisitioning procedures.
- Page 22 carries an article on the differences in operating the extended and slatted winged F-86 aircraft.
- Our cover is an ancient chart, drawn about the 13th century. It shows a continent in the Southern Hemisphere called Antichthon, believed uninhabitable because all survivors from the Flood landed north of it on Mt. Ararat.

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

STAFF

Acting Editor
Major Perry J. Dahl

Associate Editor
Maj. Jesse F. Townshend, Jr.

Managing Editor
Captain John H. Moore, Jr.

Art Editor
M/Sgt. Steven Hotch

PRODUCTION

Major Ben H. Newby
T/Sgt. Nicholas Shekita, Jr.

T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune

T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

Page

Safety — A Product of Training 2
Shakedown Artists 4
Dog in the Drink 10
I Plan to Survive 12
Just Plane Busted 14
A Winning Hand 16
The Edge in Performance 22
Well Done 25
Rex Says 26

★ ★ ★

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

Flight Safety

Awards

★

Jan. through June 1955

★

To earn is to receive. Engraved Flying Safety Plaques have been awarded to the twelve organizations listed below, in recognition of their exceptional accident prevention records from 1 January through 30 June 1955. These presentations are a compliment to the efforts of each officer and airman for his part in advancing the aims and objectives of a constant and integrated accident prevention program.

9th Bombardment Wing, Mountain Home AFB, Ida.

AF Cambridge Research Center, Hanscom Fld, Mass.

1st Weather Wing, Tokyo, Japan

Iceland Air Defense Force, Keflavik Airport

3604th Combat Crew Training Sq, Luke AFB, Ariz.

456th Troop Carrier Wing, Charleston AFB, S.C.

479th Fighter Day Wing, George AFB, Calif.

8th Fighter Bomb Wing, Itazuke AB, Japan

34th Air Division (Def), Kirtland AFB, N.M.

406th Fighter Interceptor Wing, Manston, Eng.

482d Fighter Bomb Wing (2589 ARFC), Dobbins AFB, Ga.

133d Fighter Interceptor Sq, Grenier AFB, N.H.

SAFETY

a Product of training

Colonel R. K. Gallagher, Director of Flying Safety, ATC

THE REQUIREMENT for safety of operation is implicit in the mission of all commands; however, Air Training Command has in addition the special responsibility for safety as a direct product of its training programs. This is true because Air Training Command is the prime source of personnel for other commands, and as a result our approach to accident prevention must be dual in nature.

First, we have the responsibility of preventing accidents while the student is undergoing his flight training, and, second, we must instill in the student the skills, techniques and practices that are essential for safety after graduation. These two objectives guide our accident prevention program and are basic to our efforts to graduate only those students with the necessary ability, knowledge and confidence to perform the tasks that will be required of them in their future assignments in the Air Force.

To achieve our objectives we are continually evaluating the training programs through a system of close supervision, analysis and frequent standardization checks of instructors and students. By these methods and by striving to improve the quality of instruction, we are working towards our goal of a safe program and a safe and capable graduate.

In the pursuit of our twin objectives, we have required flight safety and supervisory personnel to remain operationally qualified in the mission aircraft. I feel that the best approach to accident prevention is to require these people to have a complete understanding of the training mission and to remain active in the program so that any hazardous condition or unsafe technique can be immediately detected and corrected.

We are continually making objective evaluations of each maneuver and mission to reduce the hazards and improve techniques that will achieve greater safety and not reduce the combat capabilities of the graduated pilots. With this concept we intend to remain operationally minded and are continually looking forward to meeting the problems rather than to have an "after-the-fact" approach to accident prevention.

Both Crew Training Air Force and Flying Training Air Force have organized strong Wing Standardization Boards which are used to monitor the quality and standardization of instruction throughout the training programs. Flying Training Air Force, through its central standardization boards at Craig Air Force Base and Reese Air Force Base, assures command-wide standardization in the primary, basic single engine and basic multi-engine programs. Thus, weak points in the training programs can be spotted and changes put into effect command-wide with a minimum of time and effort. For example, when compressor stalls were recognized as a general problem area, particularly in the F-86, the corrective effort in teaching proper throttle technique was not limited to the graduate schools but was taken all the way back to the source, the contract primary schools, where greater emphasis was placed on smooth throttle manipulation.

The flying safety efforts of the Directorate of Flying Safety, Air Training Command, are directed primarily to assisting bases of this command in the recognition and elimination of any condition that may affect the accident potential.

This program is accomplished through flight safety surveys and staff visits by personnel of the Directorate of Flying Safety, by making on-the-spot recommendations of deficiencies in the training programs, traffic patterns, operating conditions at the bases and by assisting base commanders and Training Air Forces in obtaining the aid that is necessary in preventing further aircraft accidents. The concept under which flight safety surveys and staff visits are conducted is to take an active interest in the mission of the base by participating in their flying program, attending briefings and discussions with base personnel from the supervisors down through the buck instructor. Participation in the flying program is accomplished by flying with student pilots if dual control aircraft are used in the program, or as a member of a student formation training flight in a position other than lead. The pilots flying these missions and evaluating the training program are highly qualified operational pilots. The combined experience of this office represents a pilot qualification in every operational jet aircraft in the Air Force.

Recent flight safety surveys have revealed the following major areas requiring and receiving additional emphasis in our training programs:

1. The tight power-off traffic pattern has been a major factor in many Training Command accidents in the past. The power-on concept has been adopted command-wide, not only as a safety measure, but as a teaching method to allow easier transition of the student to heavier and faster operational aircraft after graduation. Acceptance of this concept has been

An impressive and effective device for promoting flying safety is this F-86 of the Training Comm

largely a job of selling the power-on approach to supervisory personnel by actual demonstrations. It is a technique that requires their own adherence and constant backing if the principle is to be observed throughout the training programs. During flying safety surveys conducted by our Directorate, these approaches are being checked, and the selling job continues to eliminate the few remaining nonconformists in ATC.

2. Fuel mismanagement, particularly in the T-33, has contributed its share to the Air Training Command accident total. Accidents of this type happen mainly to inexperienced pilots and result from inattention to fuel supply or improper manipulation of the fuel switches. The present solution to this problem lies mainly in the area of operational techniques and sound training. Formations are being spread during fuel and oxygen checks to allow the students time to thoroughly check all instruments and to determine the actual fuel remaining as well as to make accurate tank selections as required.

3. Air Training Command has always firmly believed that navigational proficiency flights are an essential part of a pilot's training. Successful completion of missions of this type add immeasurably to a pilot's confidence and to his ability to perform his job under a variety of conditions. However, indiscriminate release of pilots on cross-country flights has resulted in an unacceptable number of accidents. Many of these were caused by the complacent attitude of many new instructors or combat returnees. The new instructor had plenty of time in the traffic pattern but limited experience in planning and flying a cross-country. The combat returnee had very little Stateside or single plane cross-country experience. It was realized that restricting cross-country flights would stop the accidents, but would not correct the deficiency that caused them.

The Air Training Command's policy is to encourage navigational proficiency flights and supervise them closely. This supervision means more instruction and practice in planning and flying a good flight plan. Now, a pilot must show adequate planning, good judgment in selecting a route of flight and refueling points before a navigational proficiency flight is approved for him.

A veteran fighter pilot with 260 combat missions during WW II and Korea, Col. Gallagher has 1300 hours in jets, with 5400 hours total time.

He has flown every type of fighter in operational use in the USAF today.

★

Also, several accidents have resulted from pilots landing on strange 5000-foot, wet runways with jet aircraft. In most instances the tower advised that the runway was wet, but the pilot did not know how much braking action he could expect. Since each runway surface offers different braking action when wet, we have recommended that all bases rate the braking action as good, fair or poor on wet runways and that this information be included in the remarks section of the Radio Facility Chart. This will assist the pilot in selecting a landing field if precipitation is reported or forecast for a given base.

4. One problem receiving much attention Air Force-wide as well as in Air Training Command is VFR separation of traffic. Although other commands have their own problems in this area, we feel that ours are unique and much more serious. One need only visit an Air Training Command base, some of them flying 10,000 to 15,000 hours per month, to realize the tremendous amount and variety of training going on within a relatively limited area. This training load imposes hazards not normally found at bases outside of Air Training Command and requires that utmost care be taken to avoid mid-air collisions.

Within Air Training Command, this problem can be separated into two major categories: The separation of VFR instrument training and the control of formation flights. Several of our bases have instigated VFR approach control systems operated in a manner similar to a normal IFR approach control, which through centralized control of altitude and time separations have helped reduce the accident potential. Although the problems differ at each base, making it impossible to use one standardized procedure throughout Air Training Command, studies have been initiated to adapt variations of this system to all Air Training Command bases.

The second major collision category is that involving formation training. Formation collisions are generally of three types: collisions within a formation, collision between non-associated flights or elements and collisions during simulated combat missions. Although all the hazards associated with formation flying cannot be eliminated without compromising the quality of training, some steps can be taken. We have recommended the separation of flights by altitudes and areas, the loosening of formations during cockpit checks and the addition of an instructor pilot in either the Number 3 or Number 4 position of a simulated combat mission.

Training cannot be a one shot affair for either the student or the experienced pilot. It requires constant follow-up action by the training activities and each individual pilot must do his part in maintaining his own proficiency. I believe that one of the best examples of the necessity of this continuation training is the apparent increase in the number of accidents resulting from flameout patterns and approaches in the graduate schools, while in undergraduate training the student practices these approaches constantly and achieves a high degree of proficiency.

Upon graduation and after completion of the initial check-out phase in their tactical aircraft, this subject is neglected with a resulting lack of proficiency and knowledge of emergency procedures. Training must not stop with the acquirement of initial proficiency.

I have attempted here to outline only a few of the items where training produces a safe operation and a safe and efficient product. It is my belief that training is the key to flying safety and that efficient training is dependent on careful planning and close supervision. Although the instructor pilot is the backbone of our training programs, the key man in the accomplishment of our mission and in the quality of our graduates is the training supervisor. The future of our Air Force is in his hands. ●

Here is a story of flight safety at work. Object . . . crew proficiency.

Shakedown Artists

By Maj. Joseph P. Tracy

IN JULY 1954 FLYING SAFETY published a Well Done for Major Samuel W. Tyson of the 374th Troop Carrier Group. To refresh your memory a bit, all Sam Tyson did was bring a C-124 in for a successful landing after losing an engine. It just happened in this case that he actually lost the engine. Gone. Missing. Departed from the aircraft. In fact he did such a good job, the airplane is flying today, none the worse for the experience. This article deals largely with Sam and his people.

Recently we took a swing through the Far East in quest of material and were fortunate enough to get tangled up with the 374th Troop Carrier Wing, commanded by Col. Adriel N. Williams, and had a chance to observe their exceptionally fine operations, first hand. What impressed us most was their triple-barrelled program featuring crew integrity, a standardization flight crew and an aggressive maintenance organization, all integrated to produce safety of flight by providing proficient crews to operate near-perfect aircraft according to sound procedures.

Our interest here is in the flying game; consequently we will cover only crew integrity and standardization. (For the maintenance side of the story see "Rx For Engine Longevity" in the December issue of *Aircraft Accident and Maintenance Review.)* Sure, we've seen standardization programs before and plenty of good ones, but we feel that this program has certain facets which well might be adopted by other transport organizations within the Air Force.

Must Know Their Job

The 22nd and the 6th Squadrons of the 374th are equipped with C-124s, and many of their missions are devoted to carrying passengers and lots of them. Every crewmember has a tremendous responsibility; these men must know their job.

Naturally, the 374th has been operating under a standardization set-up for some time, but recently it was decided that even more emphasis should be placed on getting each air crewmember standardized to the nth degree. Literally, this means that any crewman can be interchanged from one crew to another if need be, to a point where all procedures are identical, even down to interphone phraseology and techniques.

Credit for recognition of the need, conception of the program and master minding it to successful fruition goes to Col. Hollis B. Tara, Commander of the 374th Tactical Group. Col. Tara appointed Capt. P. G. Smith as head of the original standardization flight crew team. He was given carte blanche as far as picking his men went; needless to say, he combed the organization to get the finest available for each crew position.

However, they didn't start operating immediately in a haphazard manner. Instead, they sat down and wrote the book; the publication contains every SOP for each crew position, from preflight to engine shut-down. After it was drafted it was sent to the squadrons concerned for review and comment. After everyone had had a crack at it, suggestions and procedures were thrashed out by a committee composed of the top brass, squadron commanders, IPs, engineering officers and operations personnel. After that, all agreed-upon changes were incorporated in the manual and the standardization board was ready to roll.

At this point, Capt. P. G. Smith, his Flight Engineer, M/Sgt. James W. Weightman and Radio Operator A/1C Calvin Green had reached the end of their tours in the Far East theater. Maj. Tyson, a Squadron Flight Commander, was selected to take the ball from this point. After thirty days of coordination and stabilizing standardization check flight procedures with Capt. Smith and his crew, Maj. Tyson was ready to roll.

As the system is now programmed, each flight crew receives a proficiency check at least once every six months. It's a thorough shake-down that is accomplished while performing an actual mission. Further, after the flight is over, every crewmember is given a written examination, covering all phases of his particular duties. Sure it's rough, but believe us, it pays off in the long run.

We decided the only way to get a good picture of this operation was to take a trip with the standardization crew and observe them in action. Consequently, we got ourselves put on crew orders for a mission to Okinawa and return.

We arrived at the squadron operations shack at 0530 and stood in the rear of the ready room while Capt. Ernest W. Frost, Aircraft Commander, briefed his crew. We noticed that while the stand-crew members listened attentively, no one took notes. This struck us as odd, and we queried Maj. Tyson as to how discrepancies were noted.

Sam told us, "It's our experience that it is poor psychology to make notes in front of personnel being checked. We have checklists for every phase of the operation. Whenever the opportunity presents itself, we bring our notes up to date. It's a progressive thing. We've worked with this thing long enough now so that we catch discrepancies fast, file 'em away mentally and jot them down later. It's surprising the number of mistakes we pick up at positions other than our own."

Individual Checklists

After the briefing, the crew proceeded to the aircraft and started the preflight inspection. Each crewmember had his own checklist to accomplish and was accompanied by a member of the stand-crew.

The preflight inspection is a combined effort by the engineering and communications maintenance crews, plus the flight crew assigned to the aircraft. Normally the maintenance crews accomplish their phase of the preflight prior to the flight crew's reporting to the airplane. Accomplishment of the aircrew preflight inspecton checklists completes their responsibilities of the Dash Six Tech Order.

During the inspection we noted that several minor discrepancies were brought to the attention of the crew chief for necessary action. Upon completion of the inspection, each individual initialed the Dash Six worksheet in the appropriate column. We asked Master Sergeant Stanley Hall, Flight Engineer of the stand-crew, how this system worked when the aircraft was away from its home station.

"Well, sir, it's like this," said Hall. "When the plane remains overnight, away from the home station, the flight engineer and the assigned crewmembers will accomplish the radio and ground crew's flight inspection requirements and certifications. At intermediate stops, the flight engineer and crewmembers accomplish the through-flight inspections and the flight engineer accomplishes the necessary forms and certifications. It's up to the squadron maintenance officer to furnish an up-to-date Dash Six worksheet prior to each flight, and, of course, we have to keep it current at all times."

Passenger Briefing

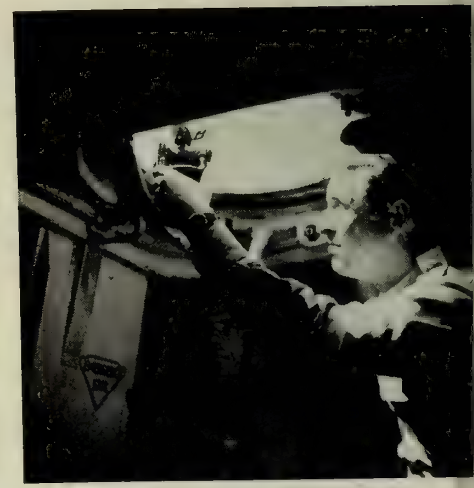
Once the inspections were completed and minor discrepancies cleaned up, the aircraft was ready to go. At this time, passengers were brought to the plane for loading while the flight crew proceeded to base ops for final weather briefing and to file clearance. The stand-crew Loadmaster, T/Sgt. James E. Stewart and the Flight Mechanic, T/Sgt. L. E. Beddow, remained with the aircraft to observe loading technique of the assigned crew.

Maj. Tyson and the two navigators assigned to the stand-crew on this mission, Maj. Joseph H. Wehrle and Capt. David D. Tracy, accompanied the crew to the weather briefing. Wehrle is currently taking over from Tracy, hence the two navigators for this particular trip. This was almost a case of the checkers checking the checkers.

Needless to say, the complete flight planning by the crew was closely

Major Samuel W. Tyson heads up the standardization board for the 374th crewmembers.

Following a complete preflight check the pilot makes a last minute instrument panel inspection while a standardization board member observes closely. Short cuts are taboo in this outfit.



Navigators also get a thorough route check to insure the highest degree of proficiency.

observed by Maj. Tyson and the two navigators. We got sort of extra interested, too, as the weather wizards casually informed us that not one but two typhoons lay between Tachikawa and Okinawa. But, after some close checking, it was firmed up that we could pass safely between the two storms, though it was obvious that some dirty weather was in the offing.

Returning to the airplane, we got in on the last of the passenger briefing, then leaped aboard and shortly thereafter were airborne in the great iron bird.

As soon as things settled down to routine flight, the stand-crewmembers got together to compare notes and fill in their own checksheets. This was an especially sharp crew being checked and there appeared to be a dearth of discrepancies.

The trip to Okinawa went off smoothly in all respects. As we progressed along the route, it was soon apparent that the crew had almost forgotten that they were being checked. These men knew their business and weren't the type to get their wind up easily.

After breaking out over the island about 2000 feet, Maj. Tyson put the aircraft commander under the hood for the remainder of the run. GCA picked us up and brought us in for a landing. This is SOP. In this outfit all landings are made from a GCA run, regardless of the weather.

We off-loaded, had a bite to eat and returned to Ops to file for the return trip. Despite PIREPS to the contrary, the weather boys told us that the typhoons would behave themselves and we could get home with no great amount of sweat.

Tyson informed us that on the return trip, the aircraft commander would be checked as an IP flying in the right seat while instructing his assigned pilot. That is just another wrinkle in the program. In reality, Capt. Frost was getting a double dose.

The first hour went along smoothly, then the radio operator came up with a rather disconcerting report. While he was informing the pilot, the stand-crew radio operator, S/Sgt. Robert J. Schmidt, gave us the gist of the message. It seemed that Tachikawa, our destination, was then carrying "Condition One," which in typhoon language means that the base was being evacuated. We were given Nagoya as an alternate and Tyson left the decision up to the aircraft commander. Return to Kadena or proceed to the alternate. Capt. Frost elected to continue, and we finally arrived at Nagoya where we RONed.

Humorously enough, we found that the typhoon had veered off at the last minute and the Tokyo area had not received even a drop of rain although aircraft had evacuated. Such are the antics of the beasties.

Crew Critique

After getting back to Tachi, we sat in on one of the most interesting phases of the operation. This was the crew critique.

Starting with Maj. Tyson, each member of the stand-crew discussed the discrepancies as well as very satisfactory operations for their respective crew positions.

Out of the many checklists and SOPs for each phase of the mission, only a relatively few minor discrepancies were noted. Just to show how thoroughly this standardization business is being taken, the aircraft commander and pilot were reminded that they should always check for fuel service immediately after landing and not wait until departure time approaches. Another minor discrepancy was noted during the power stabilizing check. The pilot was also informed that the gear and flap handles should not be moved to neutral, but should be left up after takeoff until the aircraft is completely squared away, especially under IFR conditions. Finally, they were referred to the manual on low visibility approach procedures.

The engineer's discrepancies were very minor. However, he didn't get with the scanner and go over the 781-2 and 3 of their checklist together. He failed to check the aircraft heaters on the ground. When he questioned the latter he was informed that the possibility always exists that conditions might indicate the necessity for a climb to high altitude. Heat then might well be necessary. Also as a safety-of-flight item he personally should have checked that the jettisonable life rafts were locked in place.

The scanner was complimented on his performance. It was noted, however, that prior to initial takeoff, the ADI tank was empty. Admittedly, he

Engine analysis procedures are performed by the Flight Engineer as a stand-board member looks on. Discrepancies in techniques are discussed later during post-flight critique.

had ordered it filled, but he didn't visually check for proper level or security of the cap afterwards. During the climb-out he crawled down to check the security of the "P" compartment. This was okay except for the fact that he had to take off his headset to do so without getting a crewmember for stand-by. The manual requires that all stations are covered at all times.

The radio operator didn't check all interphones while performing his part of the preflight inspection, and the cockpit clocks weren't hacked.

The loadmaster did an excellent job, generally. He failed, however, to check the emergency equipment that is specifically set aside for the crew and didn't double check the jam latches after closing the nose doors. He also overlooked the open hatch in the main cabin that provides entrance to the "P" compartment. This should always be closed while loading passengers.

No Short Cuts

All in all, this was an excellent crew. The few discrepancies noted could be attributed to just one thing. Failure to completely follow their checklists and the manual. This, then, is where the real value of the standardization flight crew shows up. Although none of the oversights were of any appreciable consequence, the fact remains that once one starts to take short cuts, or to skip even minor items, then as surely as the sun will rise tomorrow, such actions will lead to greater carelessness. Eventually they can become deadly. By catching these items, the stand-crew keeps all concerned on their toes.

The last part of the stand-crew check took place on the following day when each crewmember was given a closed book examination. These exams cover a multitude of subjects applicable to any given crew job and are based on everything from common sense to highly technical aspects that must be understood thoroughly to be answered properly.

We're glad to report that everyone passed with flying colors. And it makes you feel pretty good to know that we've got an Air Force full of real sharp guys.

We were very impressed with the whole operation, but we still wanted to observe a crew in action without a stand-crew watching over their shoulders. Col. Tara suggested that we accompany a special mission to Thailand to see just how well standardization worked in every-day operation.

As a matter of interest, this mission was actually a back-up for the first jet aircraft to be given to Thailand by the U. S. Air Force. Our part in it was carrying a refueling unit to Saigon, where the T-Birds were to stop before proceeding to Bangkok.

Each jet was flown by a Thailand officer and an American IP. Our aircraft, of course, leaped off ahead in order to pick up the refueling trailer at Clark Field for ultimate delivery to Saigon. In addition to this little dude, we had a fairish load of JP-4 in drums, 18 passengers, a couple of tons of baggage and the usual assortment of odds and ends.

CW messages received by the Radio Operator are monitored for speed and accuracy.

Right from the start, the crew functioned just as though a standardization crew was breathing down their respective necks. Their procedures were the same as we had observed on the previous flight and our interphone contacts with them indicated that the SOP for such minimized chatter was being religiously observed at all times.

Capt. Ralph A. (Doc) Mills was the aircraft commander, and they don't come any better than this lad. He had a really sharp crew composed of 1st Lt. Robert W. Schmeling, pilot; 1st Lt. James W. Visscher, navigator; M/Sgt. John F. Bistrick, engineer; A/2C Billy R. Dickey, scanner; A/1C Robert D. Gavich, radio operator and A/1C J. O. Corral, loadmaster. This outfit proved that under nasty conditions they could really function at high speed and at top efficiency. But more about that a little later.

Our arrival at Saigon was heralded with considerable arm waving on the part of the local troops. In

Above, after landing a visual inspection is performed as part of the post-flight procedures. Below, even the Loadmaster is checked for compliance with SOPs.

fact, they tried to wave us through a narrow gate within their barbed wire enclosure that was just too close. Doc Mills finally cut the outboard fans and we crept through, but it was touch and go. It seems that some of the immediate neighbors take a dim view of military operations and the old fencing took us back to the 1940-odd era elsewhere.

Once inside, the crew found they had to exercise considerable ingenuity in getting the tank trailer off the plane. There was a decided lack of equipment available to make the job easy, and consequently everyone turned to and assisted in easing the thing down the ramp. The spectators were giving a great deal of advice but that would be true in Saginaw as well as in Saigon. Finally, we got the cantankerous piece of equipment on the ground, and all breathed easier.

Crewmen Aren't Porters

To digress for a moment, we noticed something here that really scalds us. We've been traveling around via military air, either as crew or passenger, for a good many years, but there is one thing that continues to be a source of constant amazement to us. Many passengers on these flights seem to feel that the crew should and will handle their personal baggage for them. True, you won't find many aircrew passengers that pull this caper, but the people who evidently don't travel much by air sort of assume that the flight crewmen are their personal lackeys in the baggage department. This trip was no exception. Quite a few of the troops scurried off the plane, leaving the unloading to the crew. Needless to say, the offenders were quickly disillusioned by the AC and in no uncertain terms either.

The next hop into Bangkok was strictly routine. Inasmuch as we had kept one jump ahead of the annual monsoon, the weather was good but the T-Birds that followed were not so fortunate. It took them three days to catch up. Finally, we got off again and returned to Saigon to pick up that infernal trailer.

While getting loaded, we ran into a safety tip that's worth passing on. It's just one of those little things that you should paste in your hat for future reference.

Sergeant Bistrick got out his slipstick, figured the load and computed fuel needs for the hop to Clark. It came out pretty much on the plus side of the ledger. About two hours of surplus gasoline after arrival at our destination. However, the weather being what it was, Capt. Mills decided to take on a thousand pounds or so as a safety cushion.

Securing fuel at Saigon was quite a feat in itself. After getting about a dozen assorted military and civilian people into the act, we finally convinced the local fuel merchants that some go-juice was needed. This apparently upset their normal day-long siesta.

In due time a decrepit old truck chugged up with the refueling nozzle bumping along the ground. A couple of natives dismounted, looked up at the C-124 and then shook their heads. They were far more impressed with the airplane than we were with them.

Doc Mills came down the ramp, looked at the truck, then yelled at his crew to hold it. He scrounged around and found a small glass jar, filled it with gasoline from the truck and held it up to the light. It looked more like dirty water than fuel.

Next he looked around the ramp until he located a short length of wire, stuck it in the jar and started to agitate the fuel with a swirling motion. In a moment the liquid was turning like water down a drain. Immediately all foreign matter in the gasoline collected in a column, gradually dissipated in speed and settled to the bottom of the jar. Over a teaspoon of dirt and grit had collected in this one spot.

Doc didn't need an interpreter to say "No, thanks!" The truck crew shrugged, climbed back into the vehicle and went off down the road with the nozzle of the hose still bumping on the ground.

Maybe you'll never get stuck for fuel in a like spot but if so, remember this easy check for contamination.

After some more backing and filling, we finally got the trailer aboard, cranked up and headed for Clark. The weather, to coin a phrase, was alternately good and then lousy. Mostly the latter.

This wasn't too important until about half way out when, without warning, we lost almost all of our instruments. There was no turning back now, and the only thing left was the old needle-ball and airspeed. Oh yes, the stand-by compass. Fortunately, the electrical failure didn't affect the radios.

Practice Pays Off

This was where the constant practice, featuring basic instrument flying, so thoroughly followed by the 374th, really paid off. Doc Mills settled himself down to the basic stuff, told everyone to sit still, watched the weather carefully and let the old girl buck and bounce. If you happen to be an artificial horizon watcher, take heed, this flight proves the point.

Up to now there actually had been no sweat. We had a good man running the show, and he was doing a fine job. But, naturally, luck always runs in any one given direction. Now, it seemed, ours was on the downhill track. Not too long after the gages went on strike, the flight engineer reported that the oil quantity on No. 3 was going or gone with the wind. We all took a look. He was right. Doc told him, "Shut down and feather." He did, and there we were.

The whole crew continued to perform their assigned duties in a quiet and efficient manner. The aircraft commander, pilot and engineer set up the plane for 3-engine operation. The radio operator and navigator got together, established a firm fix and alerted ARS at Clark. The loadmaster and scanner broke out the Mae Wests and distributed them immediately. Passengers were directed to remain in their seats and rebriefed on ditching positions and evacuation.

A quick computation with the old slipstick showed that the aircraft could not maintain its altitude on three fans without using high power and unacceptably high fuel consumption. A further check indicated that at approximately 5500 feet, three engines would hold altitude, pulling 2100 BHP each. This was correct. At 5700 feet the altimeter stopped the slow, downward crawl, and we were in level flight once again. We can't speak for the flight crew, but we breathed easier.

The entire operation took only a few minutes and was impressive, mainly by the lack of hubbub and the quiet way in which everything was handled. We never expect to see a finer example of crew discipline. These boys knew their job and did it. Period.

About an hour out an SA-16 came homing in on us with unerring accuracy, swung around in a wide, sweeping arc and settled down on our right wing. The Dumbo pilot, 1st Lt. Dennis R. McConigle, chatted with us for a moment, looked our C-124 over carefully, then dropped a couple of miles astern. The SA-16 followed us all the way in to Clark. Very comforting.

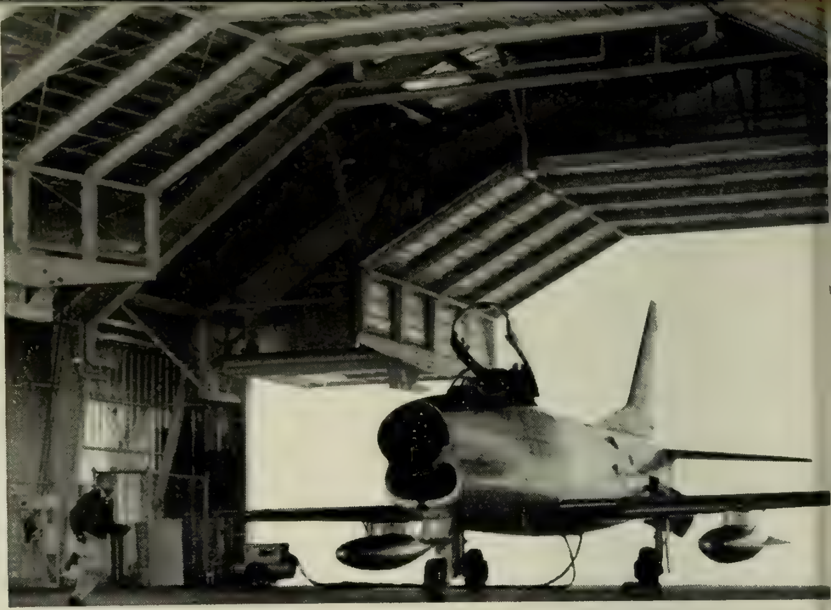
To us, the two missions we flew with the 374th proved that crew integrity and a tight, constantly monitored standardization program pays off in terms of flight safety. And in its most important aspect, that of accident prevention. The crews we observed fly together in their own aircraft; they know each other's abilities and reactions, and they follow SOPs compiled by top men in the troop carrier business. To us, this all adds up to a safety program that is really hard to beat. ●

Prior to holding critique with the crew, stand-board members put mental notes on paper. Normally, most discrepancies result from failure to follow the checklists.

This violation resulted in a • • •

DOG in the DRINK

By Capt. Homer A. Tripp, McGuire AFB, N.J.



Save This Article—Five years from now you may RON in some out-of-the-way place and get into a bull session about the most amazing accident you ever heard of and if you repeat this story without documentary proof the guy who started the bull session is sure to say "The first liar doesn't have a chance."

IT ALL STARTED at 0037 EST when Hurbert, a GCI station, placed two F-86D aircraft on stand-by for possible interception of an aircraft penetrating the ADIZ on an unknown track. Five minutes later the aircraft and track were still unknown and Hurbert scrambled both 86's for an active ADC intercept.

After becoming airborne, radio contact was established between GCI and the two aircraft. They were about 10 miles apart, and Hobnob 21, the second aircraft off, stayed in afterburner all the way attempting to join up before the target area was reached.

About 12 minutes after takeoff the lead aircraft began having radio transmitter trouble and apparently was not receiving all target information. Hobnob 21 called Hurbert and stated that he would take the intercept. Hurbert acknowledged and at this time the lead aircraft requested a heading home and aborted.

Now the guy flying as Hobnob 21 was an Irishman through and through; and sur r r r e the luck of the Irish was at full strength this dark, murky night.

The target information given was that the bogey was holding 340 degrees, 20,000 feet with an airspeed of 240 knots. This placed the point at which the interception would be made about 20 miles out over the Atlantic. Hobnob 21 made radar contact with the target and from the rate of closure he judged that the intercept was being made head on. Hobnob 21 turned and placed the bogey on his starboard wing and as he did so the bogey began a descent. This information was relayed to Hurbert who acknowledged and requested a fuel check. A check of fuel remaining revealed that Hobnob 21 still had 3300 pounds of fuel and the intercept was continued.

On a new vector from GCI, Hobnob 21 let down to 17,000 feet and again made radar contact with the target. This pass also was head on, and no visual contact was made with the target. A third pass was begun, this time closing on a quartering stern attack and letting down to 9000 feet. This time visual contact was made and with full flaps and dive brakes extended, Hobnob 21 began to close for positive identification.

Up to this point 'twas just a routine intercept, but hold your hats—from here on in the operation is anything but routine. At 130 knots with full flaps and dive brakes extended and while approximately 200 feet to the starboard and 30 degrees behind the target, the pilot felt and heard a crash or explosion. It sounded like metal on metal and simultaneously the canopy either exploded or left the aircraft and all the lights went out.

The aircraft began a spiral to the right. Attempts to right the aircraft were unsuccessful and the pilot decided to eject.

He couldn't see but believed that a portion of the canopy was still on and to avoid ejecting through broken glass, he actuated the canopy removal handle and then he triggered the ejection seat. No results! The aircraft continued to spiral to the right and the pilot decided to go over the side. He unfastened the shoulder and seat belt. He stood up but the wind forced him back into the seat. He tried again and was forced back once more. He then twisted around until he was backwards in the seat standing in a crouched position. As he crouched to dive for the wing on the right side, the aircraft struck the water.

Standing up in an F-86D when it strikes the water right wing first on a dark night does little toward increasing chances of survival. But survive he did—and without a broken bone in his body.

The events from the time the aircraft first struck until the aircraft came to rest are not too clear in the pilot's mind but from the position of the cuts and bruises he apparently was thrown into the left forward corner of the cockpit backwards with the back type chute distributing the shock up and down his back.

After it came to rest he stood up once more and released the chest chute harness and inflated one half of his Mae West. As this was accomplished the aircraft sank and the pilot went under with it momentarily. He managed to free the one-man dinghy and one leg of the chute harness and pushed toward the surface.

By the light of a fire on the surface of the water he was able to clear the rest of his chute harness and to deploy and inflate his dinghy.

Remarkable that he survived the initial impact, wasn't it? But he isn't rescued yet. He was still in the water 16 miles out in the Atlantic on a dark night, and visibility was less than

The siren sounded and the loudspeaker blatted scramble Hobnob 21. The Dog roared out of the hangar and off the runway on an actual intercept.

The seat wouldn't fire, so he stood up in the cockpit to go over the side. Then he hit the water.

good. Then too, he had no time to tell anyone that he was in trouble or to give a position. But Dame Fortune still smiled on this young fellow.

A GCI operator at Dora who wasn't even running the intercept noticed his target fade from the scope. He immediately marked the spot on the scope with a grease pencil and called the coordinates into the Coast Guard. A search was begun at once.

Up to this point luck has played the lead role. Now knowledge of rescue procedures and equipment on the part of the searchers and the pilot were needed to make a speedy rescue possible.

The pilot climbed into his dinghy and took an inventory of the survival gear available to him. The most important things he found were three day-night flares. Using his head he did not fire the flares with the vain hope that they would be seen. He did not fire them at the first sound of an aircraft overhead either. He sat and waited until he judged that a search aircraft was in position to see a flare and then fired his first one. It was seen, but the aircraft lost sight of it and he turned and dived on his position. While not successful with the first flare the search area was reduced by the new location on the pilot's position. The second flare was fired at just the right time to be seen by the pilot of an SA-16. Flares were dropped from the search aircraft boxing the area and the SA-16 started to orbit over the raft. Signals for homing were sent and a Coast Guard crash boat used the D/F bearings to home in on the position of the raft. The pilot was picked up and a remarkable rescue was an accomplished fact. Whew!

Fantastic! Sure, it is. Could the conditions be duplicated? It's not likely that they could but there are several things about this accident that we could profit by reviewing.

First, this is an excellent example of just how expensive an ADIZ violation can be. This small error in navigation cost us one good aircraft alone. Add to this the cost of rescue and the unnecessary risk of life and the entire matter becomes appalling. Certainly avoiding such costs are worth the best efforts of each of us, especially in penetration procedures.

Then there is the matter of knowing your emergency equipment and procedures. Keeping your head and investigating your survival gear. Knowing just what you have to work with. A calm analysis of your position and a knowledge of procedures is your most important survival gear.

Also very important to this whole story was the action of the GCI operator. Now you can't expect these operators to notice every target that suddenly disappears, but if they are contacted and advised that you are in trouble, they can help in many ways. A steer to the nearest airport, a position report to rescue agencies if you go down, assistance during loss of communications and even PPI approaches to nearby airfields. Being acquainted with GCI and knowing how to use their services is important. A good practice is to know the location of GCI along your route, in case of an emergency.

Then, too, it doesn't hurt to have the luck of the Irish! ●

Shortly after WW II, Major Mazza was assigned as project engineer on ejection seat development at the Aero-Med Laboratory, Wright Field, Ohio. He served as a test subject on catapult development and followed this by flying the test aircraft during the initial dummy ejections. Realizing that many pilots were not convinced that the ejection seat was a safe device, Mazza volunteered to test the seat personally. First he made four high speed ejections at a maximum indicated airspeed of 475 mph; then he made four at high altitude, setting a new altitude bailout mark of 42,176 feet. These tests resulted in the development of the present automatic ejection equipment.

I Plan to Survive!

Major Vincent Mazza, Hqs ARDC

SO FAR MY survival planning hasn't been used because I've never had a need for it. I will be delighted if this situation continues to exist. Actually since the best survival technique is a safe landing back at the home base, I have adopted this as my primary survival plan.

This primary plan is dependent on many considerations other than personal equipment, yet it is surprising how vital a function this much neglected and misused equipment can play. Little things, such as checking the oxygen mask and regulator, may mean the difference between reaching your intended base or falling short. Several pilots in Korea were saved because the emergency oxygen bottle provided an additional 10 minutes flying time at altitude. They were thus able to save enough fuel to reach friendly territory.

Making a safe landing at a preselected airfield is undoubtedly the best way to survive, but for many reasons this isn't always possible, and an emergency escape or landing is the only alternative. For emergencies such as this, survival equipment is provided to aid pilots who may be forced to survive in remote areas or in enemy territory.

Stateside pilots tend to disregard the use of survival equipment, yet there is some very isolated and rugged territory in the United States. In a combat theater the opposite is usually the case. Pilots practically crowd themselves out of the cockpit with survival equipment.

I saw a pilot in Korea who carried five guns and two belts of ammunition, in addition to other excess survival equipment. His largest gun was a tommy gun which he tied to his parachute. This man was practically immobilized in his cockpit. Here was a survival incident looking for a place to happen. His efficiency as a fighting machine was seriously hampered. He was so crowded he could hardly turn his body if a bogey was on his tail. In combat this is an invitation to disaster. In addition, this pilot had unwittingly compromised the most important phase of survival, namely, a successful escape without injury.

Most pilots were taught that the first eight hours of escape and evasion from the enemy are the most important. If a pilot is able to avoid capture for this period of time, his chances of continuing are pretty good. I have no reason to doubt this theory, but I believe the first eight hours are dependent on the success of the first few minutes, namely, the period from ejection to parachute landing and recovery. This escape phase of survival is the critical or payoff portion. The success of evasion or survival will depend on it. If a pilot is badly hurt, evasion is impossible, and survival, without assistance, is doubtful.

Well, enough theory. What can be done to make escape safer? Escape is like insurance, you have to plan for the emergency in advance. When the emergency occurs, it's too late to do much about it. Most of the planning can be accomplished by forming good habits in wearing your personal equipment. A quicker and safer emergency ejection will result. Briefly, here are some tips, sometimes overlooked, that might help you.

- Watch for items which can become a dangerous club during the windblast. The headset-microphone plug on your helmet and the A-2 adapter on the end of your oxygen mask hose have accounted for many injuries. Tie them down.
- Don't load your body with survival equipment, such as guns and open-blade hunting knives. Carry such survival equipment in the container provided. Put only soft items such as gloves or socks in your flying suit pockets. Limit the contents of this kit so it does not raise your sitting height over five inches. (This will assure that you are properly accommodated in any standard aircraft seat.)
- Check the retention features of your helmet and don't forget the chin strap. The helmet is an invaluable item during crash landings, ejection, parachute opening and ground impact. It's good only as long as you keep it on your head.
- The parachute also is good only as long as you wear it. Make sure you keep wearing it after bailout by having a good fit at the start.
- On certain aircraft (T-33 and F-94) it is possible to actuate the seat firing mechanism without pulling the canopy release lever, so don't get excited and inadvertently fire the seat through the canopy. Make sure the canopy has fired except in an extreme emergency when time is more important. Practice your ejection procedures on the ground till they become pure habit. Don't stop at simulating the ejection, remember the next step is to open the lap belt and get out of

the seat as soon after ejection as possible. As you simulate this procedure, lift yourself out of the cockpit. Notice whether you separate cleanly and if there is anything which could be a dangerous club hanging from you.

This is a rough quick coverage of the usual oversights which tend to make ejections more dangerous. If you form good habits and wear this equipment properly you are ready to eject at a moment's notice.

Now let's assume we have made an actual ejection and carry on with the story. We found that the windblast, though of short duration, could be very strong. We opened the lap belt and the next step is to kick the seat free and pull the ripcord as soon as possible. (If we are at low altitude.) This procedure sounds pretty simple, but don't let it fool you into passing up automatic equipment, if it's available. This is a very forgiving piece of equipment and will save many pilots, regardless of their mistakes or bad luck. Automatic equipment also offers the safest means of accomplishing a high altitude jump or a low altitude high speed ejection. In high altitude bailouts, trust the automatic parachute. It is a much better judge of altitude especially at night, in clouds, and over water and desert terrain. Pull manually only if you are positive you are below 5000 feet.

In preparation for landing, a modification of the A-1 survival kit plus some new information and procedures, should make landings on water or land simpler and safer. This information illustrates the methods which will enable you to be in your life raft within 10 to 30 seconds after contact. This is especially important in cold water. Evidence has shown that, even when wearing anti-exposure suits, entry into the life raft must be accomplished in three minutes or little chance of success remains.

Besides permitting a quicker entry into the life raft these practices were recommended for other reasons. Accomplishing all the necessary steps at the moment of water contact can be very confusing, if not impossible under adverse circumstances. For this reason, it is best to accomplish as much as possible during the parachute descent. This procedure also will provide many bonus effects. For instance, deploying the land-sea survival kit on a drop line prior to immersion provides many advantages.

- It provides an inflated life raft which should be rigid enough to enter by the time you hit the water.
- Any survival kit inherently floats. When this kit is strapped to your buttocks, it tends to float your head down. If you are dragged by the parachute canopy, this condition is aggravated. Head down flotation is therefore eliminated by dumping this particular kit.
- Height above open water is very hard to judge. When the kit contents strike the water this will indicate you are about 20 feet above it. During darkness, you can determine this distance by exerting pressure against the lanyard with your feet. When you hit the water, operate the canopy release immediately.
- No attachment of a lanyard from the dinghy to the life vest is required, but remember your equipment is attached to your parachute harness. Therefore, use a canopy release to deflate your parachute. Don't get out of your harness and allow this equipment to be dragged away by the parachute canopy.
- During land jumps, development of this kit rids the jumper of excess weight and bulk and provides a safer landing.

Compare this procedure with the old system and I am sure you will find it a big improvement.

The final step, that of entering the the raft to your person. Make a sea with full equipment. If you encounter stiff winds or high waves, you will find it easier to enter the life raft by turning your back to the wind. In any case enter from the small end and watch for sharp objects which could puncture the life raft (canopy releases, knives and so on). If you take off your parachute harness after you are in the life raft, be certain to tie the raft to your person. Make a sea anchor from your parachute if one is not provided. Although the primary need for a sea anchor is to provide a more stable and seaworthy raft, I recall an instance of a pilot who was sighted due to the wake caused by the sea anchor.

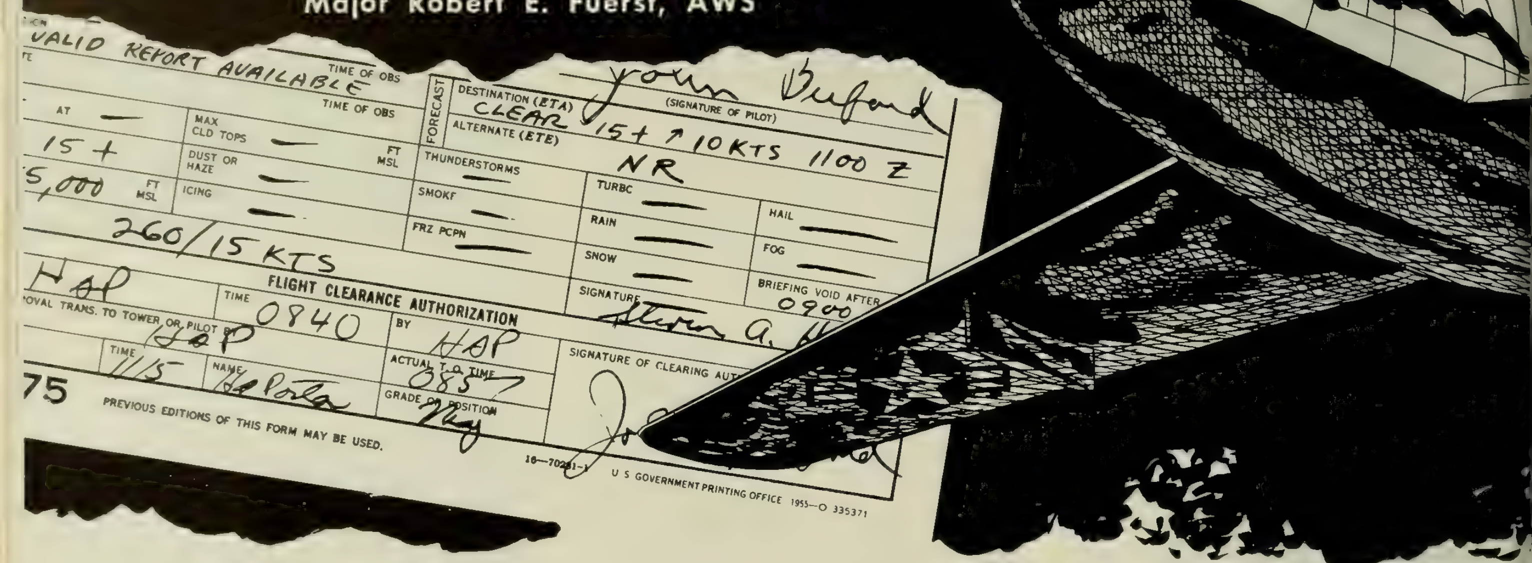
Once you are safely floating in your life raft or standing on the ground, you have completed the first phase of survival successfully. I can personally vouch for this phase. It has worked for me in the past without inflicting any injuries except minor bruises. I plan to survive by these methods in the future. I heartily recommend them to you for your survival plan. ●

Accomplishing all necessary steps prior to water contact is the recommended procedure.

Stateside pilots tend to disregard the use of survival equipment. Could you survive here?

Just Plane Busted

Major Robert E. Fuerst, AWS



VALID REPORT AVAILABLE

TIME OF OBS

TIME OF OBS

AT —

MAX CLD TOPS — FT MSL

15 +

DUST OR HAZE —

5,000 FT MSL

ICING —

260/15 KTS

FORECAST

DESTINATION (ETA) CLEAR 15+ ↗ 10KTS 1100 Z

ALTERNATE (ETE) NR

John Buford (SIGNATURE OF PILOT)

THUNDERSTORMS —

SMOKE —

FRZ PCPN —

TURBC —

RAIN —

SNOW —

HAIL —

FOG —

SIGNATURE Steven A. H

BRIEFING VOID AFTER 0900

HAP

FLIGHT CLEARANCE AUTHORIZATION

TIME 0840

BY HAP

OVAL TRANS. TO TOWER OR PILOT BY HAP

TIME 1115

NAME DePola

ACTUAL T.O. TIME 0857

GRADE OR POSITION Maj

SIGNATURE OF CLEARING AU

75

PREVIOUS EDITIONS OF THIS FORM MAY BE USED.

16—70261-1 U S GOVERNMENT PRINTING OFFICE 1955—O 335371

I'VE BEEN A weather forecaster for several years now and I've seen a few missed forecasts along the way. There was one early this year that was among the worst—Old Grif is lucky he's still alive.

At the time it happened, I was staff weather officer for the 67th Fighter-Bomber Squadron on Okinawa, an outfit that had recently moved down from Korea. When tension began to mount in the Orient over the Tachen Islands, the 67th was alerted for duty in Formosa, and I started a preliminary study of Formosa weather to get an idea of what to expect.

As I became familiar with the weather patterns over there, it seemed to me as if I were in for a pleasant and successful forecasting spell during my stay on Formosa. It would be February, the dry season of western Formosa. A high range of mountains runs from north to south down the middle of the island, and we would be located at Chiayi on the plains of the west coast. With daily northeast winds across the mountains there should be downslope flow and dry, fair weather at our field.

No reports were available from Chiayi itself, but there were records and reports from Tainan, a base some 35 miles away. A study of Tainan weather verified my ideas of fair and favorable weather for the month's TDY activities.

On the morning of my departure I checked at base weather, and after a discussion with the duty forecaster we agreed that the outlook was for excellent weather that day in the Chiayi-Tainan area. There were no valid reports from Tainan at the time, but there was a forecast from them and it called for the good weather to persist.

On the way to my C-47 I stopped by Fighter Headquarters and briefed the operations officer on the weather situation, pointing out that the outlook was for continued fair weather. I suggested that when the flight leaders stopped by base weather with their clearances they check the latest Tainan weather, since the reports I had were too old to be valid.

Climbing aboard the Gooney then, I left for Formosa. The C-47 seemed as slow as an Air Weather Service promotion. Almost five long hours it took, while the Sabres made it in less than one. I arrived at noon, just in time to learn that there had been a bad aircraft accident.

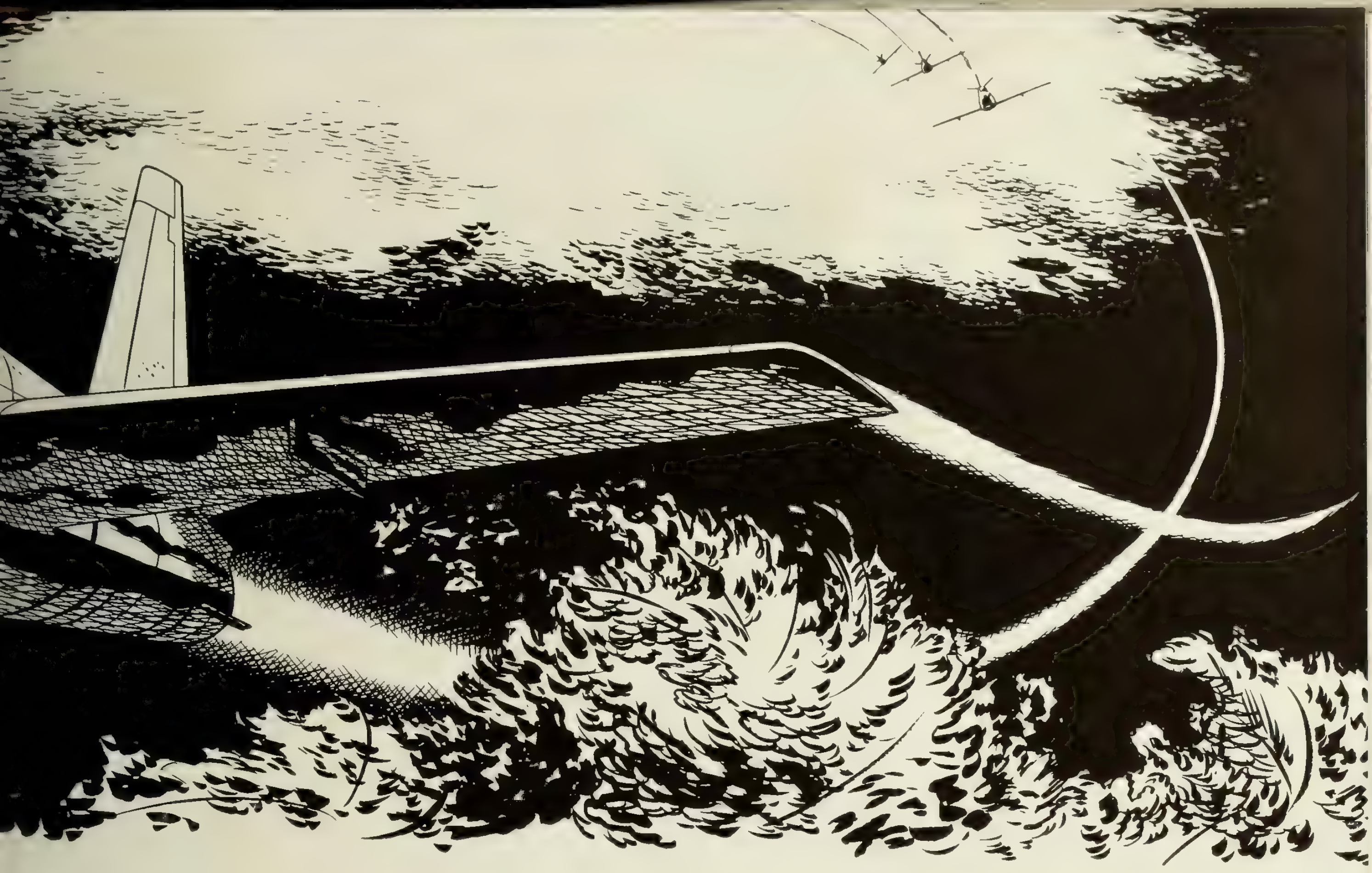
A flight of four Sabres had taken off and when they had reached Chiayi, the weather was stinko—300 feet and one mile. To make things more interesting, GCA was out. An awkward situation. Four birds above a low deck of stratus at a strange field in an alien country, with fuel running out rapidly. They tried an ADF letdown but when they were still above the stratus deck at 1500 feet, they gave that up, climbing some and dropping the pylon tanks.

One of the birds spotted a break in the undercast near the mountains and peeled off, the others following. The four of them dove through and hissed along the tree tops toward the field, trailing one another and hoping for a glimpse of the runway before fuel got too low.

"There it is!" shouted the lead bird, and you could almost see him pointing at it.

The first two got in the pattern and landed. The third one lost the field and then found it again just before giving up; he also got down. The fourth man, Old Grif, never did get to see the field.

He swerved to avoid a hill and lost the others. When he was down to 150



pounds and the field was still not in sight, he eased up to 6000 feet through the stratus deck and announced over the radio, "I can't stay down any longer."

Pulling the armrests, he released the canopy. So far, so good, he thought, and reported, "Canopy clear." He paused a moment, then he spoke into the mike again and there was a grin in his voice, "As they say in the comics, Sayonara." He pulled the trigger and was hurled into space.

The plane plowed into a sugar cane field and was completely destroyed. Old Grif floated down under his white parachute, scratched a little from his blown-off helmet, but otherwise all right. He soon rejoined his flight at the base.

In the initial flurry of excitement most attention centered about Old Grif and his close call. But when investigators began looking into the accident they uncovered several interesting points about the flight.

First, the birds had taken off on a tactical clearance without a trip to the weather station. They had obtained weather by telephone.

Second, base weather received no reports from the destination. Chiayi weather observations were not included on the teletype sequence.

Third, while en route the flight was unable to get terminal weather from Okinawa or Taipei Control. They tried both.

And there were more items: The briefing procedures, the lack of an alternate outside the immediate area, the part played by supervisory personnel, the weather itself and so on.

What it really boiled down to, however, was a busted forecast. A reasonable and logically arrived at forecast, but still a bust. Even if the pilots had shown up in the weather station in person, they would have received the same forecast—good weather at destination. It was a sound forecast, but one which did not verify.

Fortunately there were not four demolished birds and four dead pilots. There could have been. Not that the weathermen were goofing off, not at all. Weathermen probably feel worse about busting a forecast than the poor guy who's flying. No, the weatherman doesn't do it on purpose.

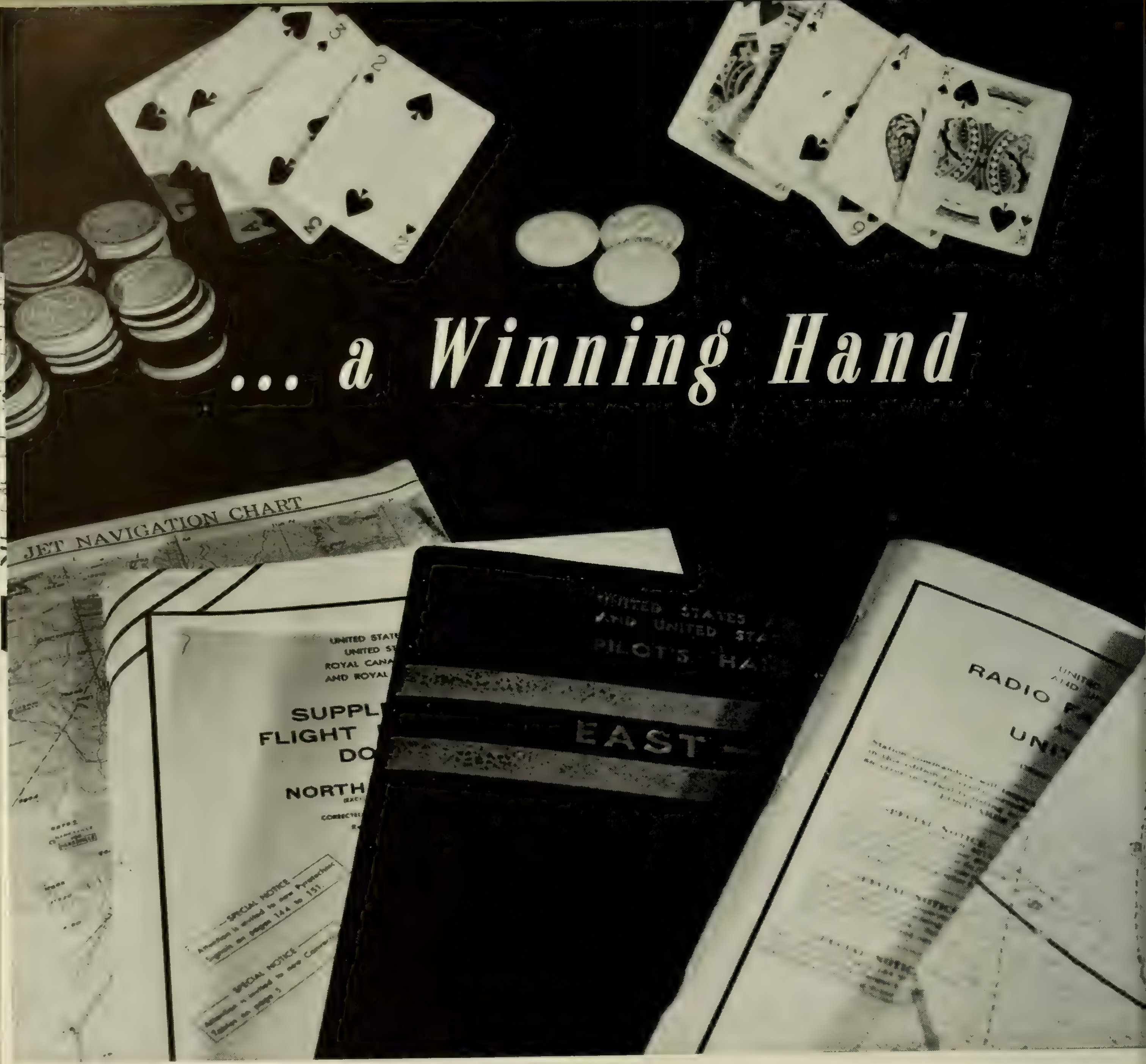
Meteorology is still a junior science and the forecasting end of it will not improve very rapidly for many years. You can expect an occasional miss as long as you are part of the flying game. There are good men in the weather business, capable men, men of integrity. But they still miss one every so often.

What's the answer then? Ignore the weatherman? Listen to his forecast with reservations?

Not exactly. But there is one thing you can do. Accept the fact that there will be a time or two in your career when destination weather will be lousy—contrary to what the forecaster said. So, whenever you get briefed in the weather station be absolutely certain that you have a reliable alternate. Refuse to consider one that is marginal or doubtful. Take two if you want, they're free. But when you leave the ground, have an alternate that you're fully confident about, even if everything else concerning the flight is uncertain.

Never trust the weatherman—never trust him to be infallible, that is. Even by intelligent thinking he can make an error. Always insist on a good alternate. Give yourself that extra peace of mind by choosing the alternate that is entirely dependable. It really pays off. ●

... a Winning Hand



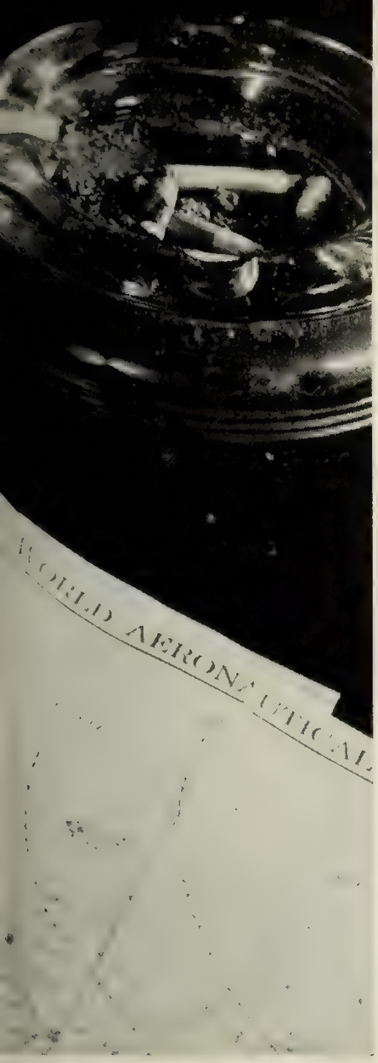
IT'S BEEN SAID that certain creatures have direction-finding capabilities. And it must be true. That 50-pound salmon that got away last year has no doubt gone upstream to return to the same spawning ground from which he came. Research proves that's the habit of fish.

The homing pigeon doesn't have a street map, but where can you get that kind of delivery service? Not even from Western Union. And comes the first chill of autumn, certain migratory birds take off under any weather condition—IFR or VFR—makes no difference to them. With unerring navigation, they wing their way south. They land without mishap to spend the entire season in a more pleasant locale.

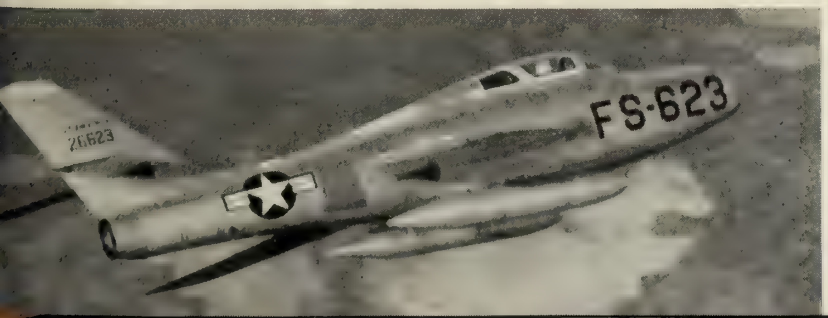
Human Factor

Man, constructed the way he is, has certain difficulty in imitating the bird. He managed to achieve wings about 50 years ago and modern technology has so improved that now he can fly faster than the speed of sound. It's not a common occurrence, true, but it is possible to eat breakfast in San Francisco, lunch in New York and be back home in time for dinner. And who know's what will come tomorrow, with perhaps atomic propulsion to serve as an activating force and an earth-circling satellite as a destination for some super plane?

But Joe Pilot doesn't have a built-in direction-finding system. And there are no engineering development projects we know of to change the characteristics of the human body. He will probably continue to refer to a very



complicated instrument panel to accomplish all of the operations or maneuvers necessary to complete his flight. Also, he'll continue to need charts and aeronautical information



There wasn't a familiar landmark and he was running extremely low on fuel.

Man, constructed the way he is, lacks the homing sense of a pigeon. Therefore, he has to resort to using charts.

F. H. Redmond, Aeronautical Chart and Information Center

publications not only for direction-finding purposes, but also for flight planning, radar and celestial navigation and 500 other good reasons.

A Chart in Hand

True, these charts and publications of tomorrow may present an entirely different appearance from those in use today. They may be combined in a one-sheet item or a small pocket notebook, which will give all the information needed for planning, navigation and letdown at any desired destination. They may be furnished for use in conjunction with a radar scope or with a movie projection screen in the cockpit. Regrettably, these superior items are not yet available, or at least not yet in production for general use. And since they aren't, it's pretty important that the pilot get and use those charts and publications which have been specifically developed to meet all phases of today's flight operations. A suitable chart or publication in the hand is a good thing to have since man doesn't have the same direction-finding system as the bird in yon bush.

Ye Olde Tale

An oldie, as stories go, concerns a pilot named Oscar J. Airwicke, an intrepid Air Force pilot (???) who is on a routine flight mission from a base in Arizona to Shreveport, La. Oscar is flying along somewhere in Oklahoma—jets travel fast—and he isn't worrying at all. In fact, as he zooms along he is not bird dogging the radio range but is listening to the strains of "Dance With Me, Henry," which waft along the air waves from the nearest commercial broadcasting station. He dreamily envisions that voluptuous doll he danced with in Toledo the other night, and wonders how soon he can dream up a legitimate excuse to get over there again. But the music slowly fades away. And somewhere in the back of Oscar's mind, a warning bell rings. He realizes he should be nearing his destination, right now!

A glance over the side of the cockpit doesn't reveal any familiar terrain. In fact, about the only terrain Oscar sees at all is a scrap about as big as a very small cow pasture over his left wing. Except for this, a very inconsiderate mass of clouds is completely obscuring the ground. Oscar realizes that he must act, and act quickly.

What to do? He twists the nose of the bird dog to Shreveport, but Shreveport is not there. Nothing, he gets. A calculation of fuel indicates he doesn't have a lot of time to stooge around in the overcast.

Oscar is now on the mike, shouting "MAYDAY-MAYDAY." He gets an answer from a control tower down in Southern Texas, or is it Tennessee saying, "What seems to be your trouble, son?"

Oscar is very much relieved. He speaks up, "This is Air Force jet 12345, and I'm lost. Give me a steer. My fuel is getting low! Which way do I go, Joe?"

A heavenly voice comes back and says, "We have a fix on your position and, well—just repeat after me, son: 'Our Father, Who Art in Heaven . . .' "

Now we know these words were never said, but more than one pilot has been lost, and perhaps for similar reasons. Our contention is that if Oscar had had the latest charts and publications, and had been making constant reference to them, he wouldn't have goofed. He'd have known the direction and location of the nearest airfield, as shown on his Jet Navigation Chart. His Special Edition Radio Facility Charts would have shown him whether that airfield had DF equipment, and whether jet servicing was available. His Jet Pilot's Handbook would have given him the proper information required for an instrument letdown.

True, you may think that Oscar was a hopeless case to begin with, but accident reports show that pilots get into serious trouble because they may use WAC charts which do not show the current frequencies of radio facilities. A contributing factor in an accident may be the fact that the pilot doesn't have the AL chart covering his alternate.

Available Charts

So bear with us while we ask if you know the answer to certain questions: WHAT charts and publications are available for your flight operations? WHICH of these are normally available in the aircraft? Do you have all of them? If not, WHO makes them? WHERE and HOW do you get them?

To check the answers to these questions, there is no better single source of information than the USAF Catalog of Aeronautical Charts and Aeronautical Information Publications issued for the Air Force (AFR 67-3) by the Aeronautical Chart and Information Center (ACIC) of the Air Photographic and Charting Service (MATS). It is published once each six months and revised by a twice-monthly Bulletin and Quarterly Bulletin Supplement.

They say that not many people have ever seen this catalog. "They say" is a short form not included in JANAP but generally reserved for miscellaneous and sundry information contributed by indigenous and anonymous personnel. But anyhow, rumor has it that when a revision to the USAF Catalog of Aeronautical Charts and Aeronautical Information Publications is received at a base, it's routed to the map and chart office. Here, presumably in the interests of security, the big sergeant in charge locks it in the desk of the rear office.

This may not be true at your base perhaps you've consulted this catalog more than once to determine what briefing and inflight data is available to you. But if your group, squadron or detachment doesn't have a catalog, the same big sergeant should request one from the Aeronautical Chart and Information Center, 2d and Arsenal Streets, St. Louis 18, Missouri.

While this little gray-backed number may not offer the same fascination as Esquire, it does present a great deal of data in condensed form. A graphic index pictures for you the exact areas of the world for which charts are published, ranging from World Aeronautical Charts to USAF Pilotage Charts, USAF Aeronautical Approach Charts to USAF Navigational Flight Charts, USAF Aeronautical to Planning Charts and USAF Outline Planning Charts to USAF Gnomic Tracking Charts, to mention a few. Described are USAF/USN Radio Facility Charts and In-Flight Data (RFC) publications, USAF/USN Pilot's Handbooks, both conventional and jet, USAF/USN Supplementary Flight Information Documents, the USAF Foreign Clearance Guide, and other special items such as the Air Almanac, Hydrographic Office Navigation Publications and certain CAA flight information publications procured for Air Force use. If breathes there a pilot who doesn't know exactly WHAT each of the above listed charts and publications covers, we believe he has plenty of company.

Millions of Charts

These items are available from or through the Aeronautical Chart and Information Center (ACIC) which produces or procures and distributes each year more than 90,000,000 charts, publications and related items to meet Air Force needs. There are six Aeronautical Chart and Information Offices (ACIOs) also which—if you'll pardon the expression—girdle the globe with charts and publications. Located in Germany, the United Kingdom, Canal Zone, Alaska, Hawaii and Japan (see the catalog if you want an address), they stock and give out with charts and they publish Radio Facility Charts and other items to meet Air Force requirements. A Washington detachment keeps in touch with Air Force Headquarters and other Government agencies and collects air intelligence and US flight information for use in various charts and publications.

The catalog, under headings entitled in good ole military terminology "Basis for Distribution" and "Requisitioning Procedures," furnishes the answers to questions such as "Do I have the chart or publica-

Latest data will be printed on these charts.

A 3-D scope is used with overlapping aerial photographs to check elevation contours.

tion I need?" "How can I get it?" or "Why can't I get it?" While it's always more pleasure to furnish the answers to the first two questions than the last one, it is necessary for various reasons—not the least of which is the budget—to limit distribution on certain items. But if you read the "Basis for Distribution" and you're in, then requisition what you need through your prescribed channels, giving any justification you think might be necessary.

And if by any chance, the catalog doesn't list the item you need, don't give up. Maybe, and this was a more common maybe several years ago than now, you need something new for jet operations. Maybe there's some other special operation that requires a tailor-made chart. It's possible ACIC may have something on the drawing board or hot off the presses which will meet your needs. Listed as examples are a few items which have been under development during the last several years. FLYING SAFETY will tell you more about some of these at a later date.

Jet Navigation (JN) Charts—Developed for use by jet aircraft with radar and celestial capability, these charts already cover the Northern Hemisphere and eventually will cover the world (see the catalog).

Special Edition Radio Facility U. S.—Large, sheet type radio facility charts with an In-Flight Data booklet were developed in 1953 for use by jet aircraft. Approved by Headquarters USAF for use by certain major air commands, they are described in the 1 July 1955 edition of the catalog. Development is continuing with a view toward improvement of this publication. The Aeronautical Chart and Information Office in Germany has recently published, as an experimental item, a similar chart for jet aircraft.

Low Level, High Speed Navigation Charts—Inasmuch as the terrain presents a somewhat different picture as you whisk by hills and through vales at high speed and low altitude than it does under normal flight conditions, a different charting concept is required. Development of a suitable chart and related graphics and techniques is under way at ACIC.

Charting for TACAN—The Aeronautical Chart and Information Office in Alaska has furnished experimental charts and graphics for use by the Alaskan Air Command in the test and evaluation of TACAN. As requirements develop in the United States, more charting projects will be undertaken.

North Atlantic Radio Facility Route Charts—Developed by ACIC for use by MATS in ferrying jets across the North Atlantic, this chart is now under test and evaluation.

Tailwind Navigation Chart—Scheduled for production in the early fall of 1955, this chart was developed as a result of collaboration between the Pacific Division, MATS and the ACIO-Hawaii, for MATS tailwind flying from Tokyo to Honolulu.

Jet Flight Information—Midget-size manuals containing both radio chart data and letdown procedures were published several years ago by the Aeronautical Chart and Information Offices in Alaska and Japan for use by jet aircraft in the Alaskan and Far East areas. The 1 July issue of the catalog lists these for the first time as approved for regular operational use in those areas.

Pantograph is used to trace details and elevations onto charts from aerial photographs.

So inquire if you don't find the particular chart or publication you need for your flight mission. It may be available or under development. Future developments may be based partially upon such inquiries.

Reporting Errors

While aerial photography is probably the best source for preparation of aeronautical charts, do you know that even with the aerial photography missions flown during World War II, and subsequently, that far less than half of the world is adequately covered? Since the issuance of a WAC chart, highways may have been rerouted. You may have reason to believe from actual flight over the terrain, that the elevations given for certain obstructions aren't quite accurate. A radio frequency may have changed, but the new one is not given in the

Like detectives looking for flaws, editors compare old letdown charts with the newest flight information and aids to navigation.

To determine chart contour lines, entire mountain ranges are measured meticulously.

RFC publication, and you don't see a NOTAM at base operations, either. An airport you try to use may be closed; you may not find a NOTAM anywhere covering that. An error may occasionally creep into a chart or publication, human beings being so awfully human. It's entirely possible too that those humans just didn't receive the latest information.

You personally can do something very important for ACIC, for yourself and for any other Joe who flies the skyways, whether he follows the highways, the airways or a compass course. That is, help insure that charts and publications are accurate and current. Report any error or discrepancy you may find.

A Note to ACIC

To illustrate that the help of the conscientious military user is needed, the detachment commander of the Aeronautical Chart and Information Office in Hawaii describes an incident which shouldn't ever happen to you or any other pilot.

It's not a familiar route you're flying today, but you've flown a lot of them. Takeoff through the overcast is uneventful. You level off at 10,000 feet and settle back for that cup of coffee that's been brewing in the galley. The navigator, having scanned the terrain clearance along the flight route on his aeronautical chart, has ascertained that all is well. As you've done a million times or more, you reach in your pocket for the crumpled pack of your favorite brand and prepare to light up.

Suddenly you observe out of nowhere a sawtooth peak poking its ugly head too close for comfort up into the immediate overcast just off your right wingtip. The coffee in your mouth turns bitter, the cigarette is forgotten. With a nervous grab for the intercom you call your navigator, "Bill, look out to your right; we're not on course. Our altitude is 10,000 and this chart doesn't show a blasted thing."

Maybe your navigator checked and found you were on course. That peak unsung and uncharted was there. We hasten to say this was only a hypothetical example; we don't believe it ever happened to you. But say it did, or an incident at all similar. Say, too, the rest of the trip was uneventful, ETAs right on the button, visibility clear at your point of landing, everything just fine.

Report Those Errors

Did you report the incident to base operations when you landed? As an alternate, did you personally write to ACIC (or to the Coast and Geodetic Survey, if the chart covered the U. S., and its territories and was published by them)? Did you say, "Look, this chart is strictly for the birds. It needs checking at such and such a place?"

Or did you get involved with such items as closing your flight plan, getting transportation to the VOQ, or dialing the phone number that Mac, your buddy, gave you of a reputedly very cute doll in town—so that the only time this item may ever have been mentioned was in a gripe session at the club over a bottle of brew?

We're not trying to make you feel like a "dirty bird" if you ever failed to report any errors. We certainly wouldn't want to shake your faith in our charts. They are compiled from the best sources of available information. We're just saying what you could do to help ACIC to serve you more effectively.

Our detachment commander in the Canal Zone gives another example of an incident that could happen to you any day if you were flying down Mexico or South America way.

You're doing a little experimenting with the radio compass when suddenly a loud and clear station identification signal attracts your attention. Obviously, you're very near the station and upon flipping the switch to compass position, you notice the azimuth needle swing definitely to 35 degrees and stop.

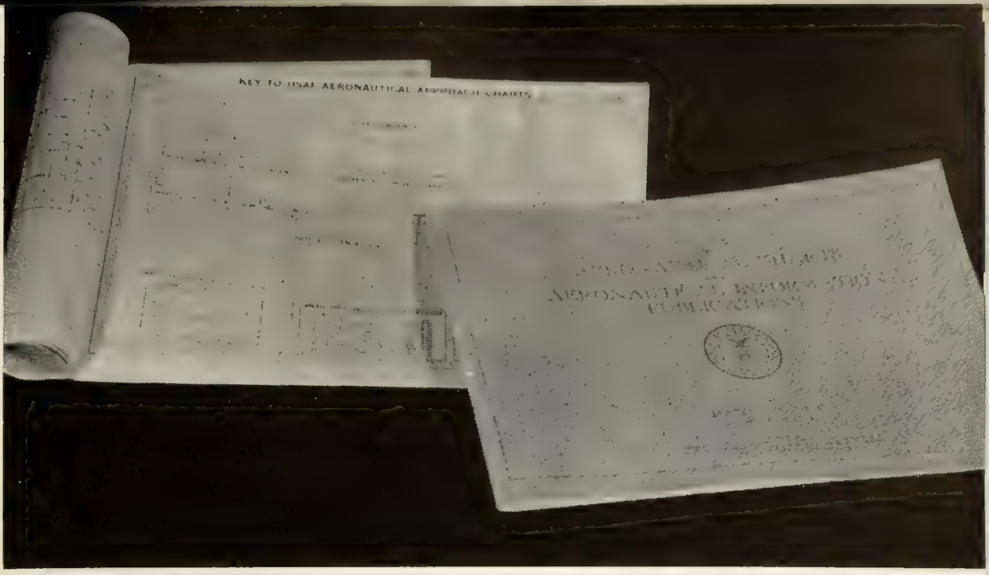
A quick glance at the Radio Facility Charts doesn't reveal a radio beacon within 75 miles. You check the "Range and Beacons by Identifiers" section and the call sign isn't listed there. In less than two minutes, the needle has moved about 90 degrees to the right, which confirms your opinion that you're very close to the station.

"Well, this is unusual," you remark to your copilot (who is busy auditing his trip expenses. You know —Cash expended, $128; Per Diem due in, $38. Only three days out.). You idly discuss this item for a few minutes; once or twice later on, you think of jotting down a note about the beacon. But, why bother? The ACIO at Albrook AFB probably has the information, and it'll be in the next issue of the RFCs.

On the return trip, the same route is followed; you're approaching the same location. The old Gooney is

fairly well loaded with cargo and you're making preparations for what appears to be heavy rain with the usual amount of turbulence. Your cockpit forecast was pretty close. But a rough engine right in the middle of the weather! You hadn't anticipated that.

This being an "All's well that ends well" story, the weather broke after about 20 minutes. The engine smoothed out and for all practical purposes, it was another 20 minutes of "W" time to log and a write-up on the Form DD-781 (used to be 1A) concerning the rough engine in heavy precipitation.



The best single source of information for acquiring charts and publications is the ACIC Catalog.

Skilled technicians range from draftsmen to linotype operators. ACIC produces, procures and distributes ninety million charts, publications and other items to meet USAF needs.

But there are two or three suppositions you might make. First, you might have been carrying passengers instead of cargo. The engine might have failed completely and maintaining the minimum altitude would have been an impossibility. A nice runway might have been near the beacon. The frequency and identification of the beacon would have been a good thing to know.

Don't wait until you're home to jot down that note. The old bell may not ring so clearly. But if you forget the details or lose the note, let your ACIO or ACIC (Washington Office for the U.S.) know there is a change. It's very difficult to maintain aeronautical information in a current status in areas like Central and South America, where the NOTAM service isn't all it might be and radio facilities are subject to quick change. So wherever you may be, it's a good idea to make that note. If you find a NOTAM in base operations covering that particular item, then and then only, forget it.

Drop a line to ACIC or the appropriate ACIO and inform them of any errors you note on charts or publications. If it happens to be the Radio Facility Chart and In-Flight Data U.S. publications, just tear one of the postcards out of the book, get out your pencil and write a note, fold and staple the card to the correct address and drop it in the nearest mailbox.

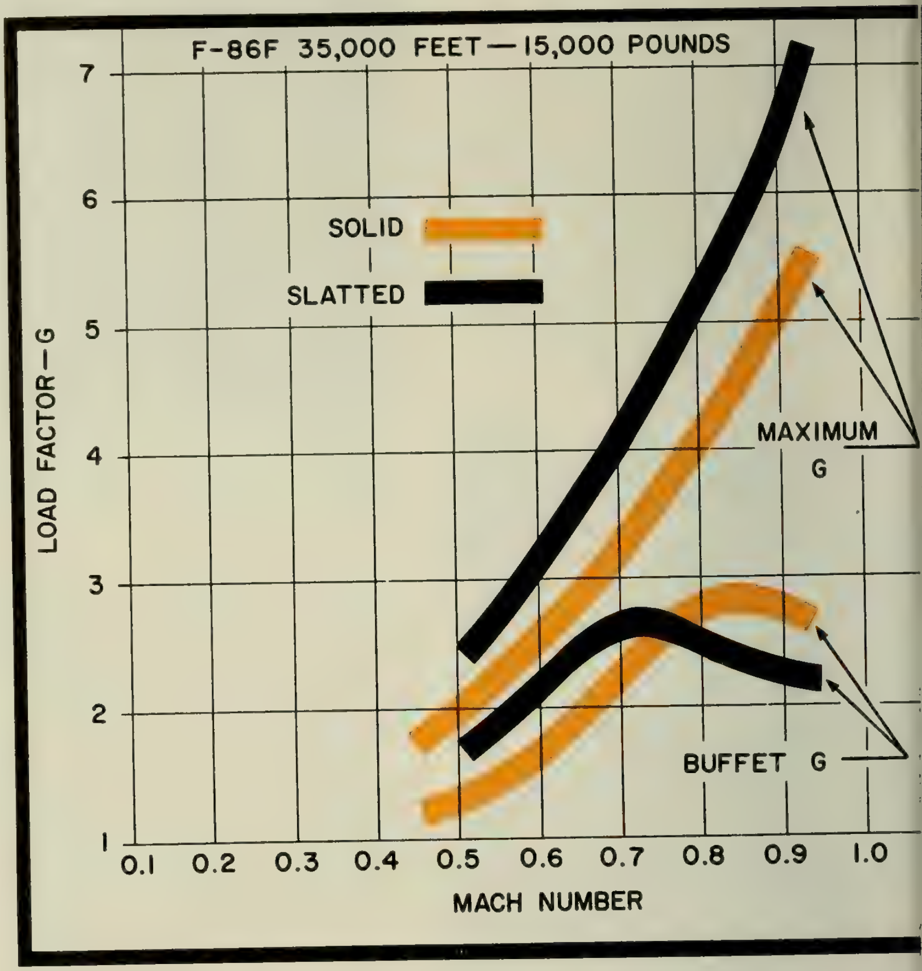
Special Notices

Special notices regarding some of the recent changes in RFC publications could be aptly titled "You Asked For It" since they resulted primarily from a number of requests sent in by postcard or letter. To mention several: Addition of mileage bar scale to chart pages, RFC US; addition of Air Route Traffic Control boundaries and Air Defense Identification Zone boundaries to Planning Chart, RFC US. These give you examples of the power of the pen and pencil. Don't underestimate the help that you can give in maintaining up-to-date charts and publications, which contain all the information you need.

We reiterate: Request the charts and publications you need. Check to make sure they're available for your use in flight. And if some particular item or development would facilitate your mission, don't hesitate to pass this information on. The item you need may not be available today, but perhaps it will, tomorrow.

After all, 30 years or so from now, the present jet may be one of the slow pokes of the aviation industry. From San Francisco, you may be able to run over to Paris for a night out on the town. We're not just kidding, son, this was a prediction of scientists who attended a conference of the International Astronautical Federation in July of this year. Just check then as now to make sure you have the charts and publications you need, and use them. Repeat after me: "Navigation without the latest chart is strictly for the birds. Man needs a chart for getting around." ●

Fig. 1. Greater maximum G provides better aircraft maneuvering characteristics up high.

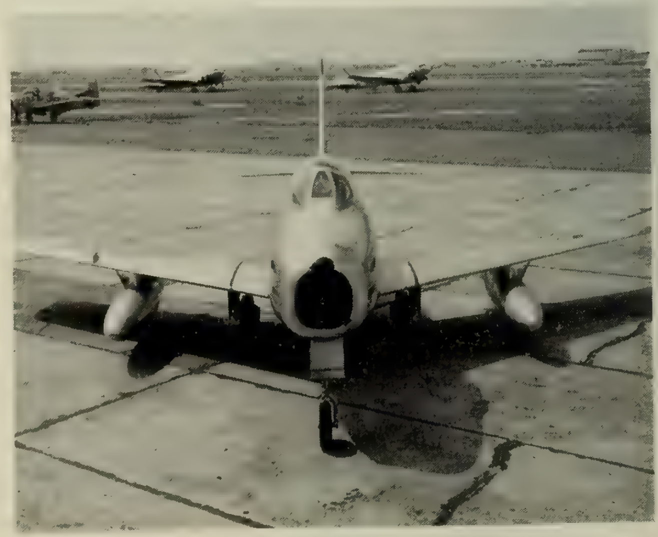


the Edge in Performance

Dan Darnell
North American Aviation, Inc.

A test pilot compares the flight characteristics of the F-86 with both the 6-3 solid and extended slatted wing.

The F-86H is shown with the hard, extended leading edge wing and with the extended slatted wing.



NO MILITARY airplane is ever a finished product. From the time it comes off the production line until it is scrapped as obsolete, continual changes are made to improve its flight characteristics and performance. Many of these are minor, and their value is not immediately apparent. But once in a while a modification radically alters the flight characteristics of the airplane. Such a change is the addition of the 6-3 leading edge to F-86 airplanes.

The 6-3 leading edge was introduced during the Korean conflict. At that time, the slats on some F-86s were replaced by solid leading edges. The new solid section extended over the original wing contour six inches at the fuselage inner section and three inches at the wingtip. From these dimensions, it received its name.

The new leading edge was added to increase usable G at altitude. This improved F-86 combat effectiveness against the MIG. But some low-speed characteristics suffered, and it became necessary to install a wing fence to regain some of the lost qualities.

The first airplane with a slatted 6-3 leading edge was not flown until about 18 months ago. The new leading edge included slats on the 6-3 extension and 12-inch wingtip extensions; it retained the advantages of both of the preceding leading edges.

With the addition of the 6-3 slatted leading edge, the F-86 regained the low-speed handling characteristics made possible by the old-type slats. Low takeoff and touchdown speeds resulted in shorter takeoffs and landing rolls.

Also, the improved landing pattern handling characteristics will undoubtedly reduce the accident potential, especially during the approach for landing phase of flight.

One respect in which the new slats differed from the old was that the old-type slats would not open above .65 Mach, regardless of how much G was pulled; under some conditions, 6-3 slats open as high as .9 Mach. Therefore, above 25,000 feet altitude and faster than .65 Mach, the 6-3 slats provide in some instances up to 100 per cent more usable G than old-type slats. This means a great deal more maneuverability.

Let's compare F-86 performance with and without 6-3 slats as shown in Figures 1, 2 and 3. These figures apply specifically to the F-86F, and the F-86D. However, much of this

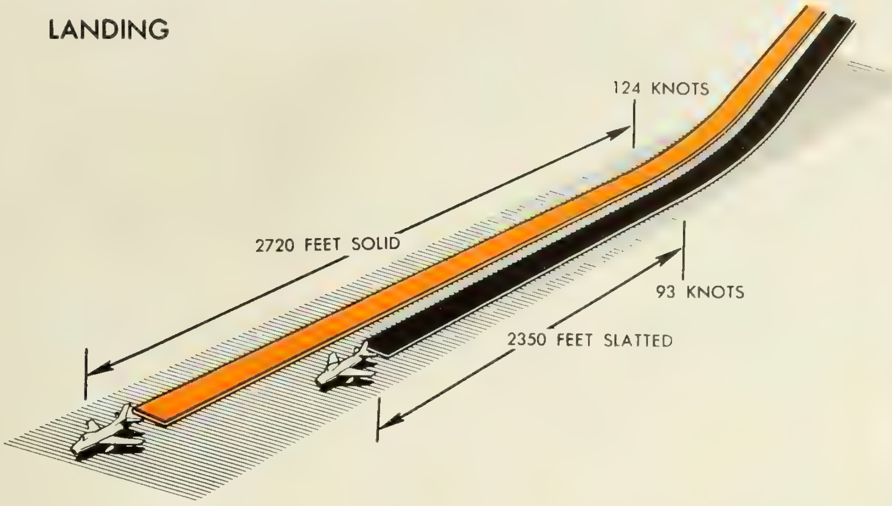
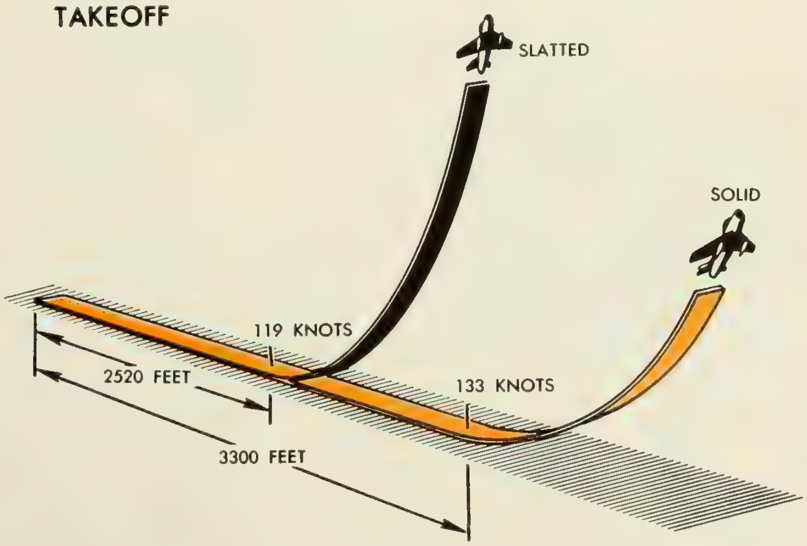


Fig. 2. F-86F takeoff and landing comparison shows differences between solid and slatted leading edges with two 200-gallon external drop tanks installed.



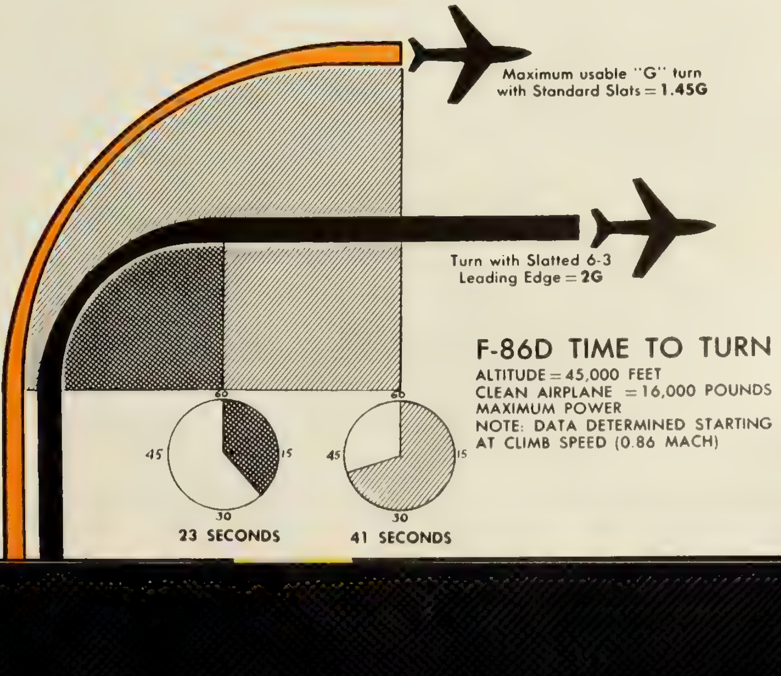

Maximum usable "G" turn with Standard Slats = 1.45G
Turn with Slatted 6-3 Leading Edge = 2G
F-86D TIME TO TURN
ALTITUDE = 45,000 FEET
CLEAN AIRPLANE = 16,000 POUNDS
MAXIMUM POWER
NOTE: DATA DETERMINED STARTING AT CLIMB SPEED (0.86 MACH)
60
15
30
45
23 SECONDS
60
15
30
45
41 SECONDS

Fig. 3. At 45,000 ft. the slatted 6-3 leading edge wing allows tighter turns.

MINIMUM-RUN TAKEOFFS

During a minimum-run takeoff in F-86 series aircraft, the airplane lifts off near the stalling speed. The landing gear should not be retracted until the airplane accelerates to the normal-run takeoff speed given in the Flight Handbooks. This is five to 10 knots faster than the takeoff speed for a minimum-run takeoff.

When the airplane is very close to stall speed, retracting the landing gear may cause a nose-up pitch sufficient to cause a stall. Waiting until normal-run takeoff speed is reached or exceeded eliminates this hazard.

Correct takeoff procedure is given in your Flight Handbook, which includes limit airspeeds for raising landing gear and flaps. This procedure should be followed.

information is generally applicable to all F-86 series airplanes.

Figure 1 shows the G available with slatted and solid 6-3 leading edges. For example, at an altitude of 35,000 feet and at .9 Mach, we find that maximum G is approximately 6.5 with the 6-3 slatted leading edge. Under these same conditions with the solid leading edge, there is less than 5G available. We have an extra 1.5G to use for maneuvering.

The lower curves in Figure 1 show buffet initiation (load factor where buffet is first encountered). After buffet is encountered with the solid wing, increasing the load factor increases the buffet magnitude until it is impractical or impossible to increase acceleration because of stall.

With the 6-3 slatted leading edge, increasing G after buffet initiation does not always increase buffet. In some cases, buffet may actually decrease. As a turn is entered, a mild buffet may be encountered before the slats start to open at higher Mach numbers. However, when the slats open, the buffet will decrease or, in some cases, remain at a constant level, allowing the pilot to continue to pull more G. Therefore, the pilot can tighten his turn with less loss of speed and greater stability than with the solid leading edge.

Figure 2 compares takeoff and landing characteristics with slatted and solid 6-3 leading edges. We find that lower indicated airspeeds are possible with the slatted leading edge, and yaw or roll experienced with the solid leading edge is not encountered. Therefore, we have lower touchdown speeds during the landing phase. The result is slower pattern and approach speeds plus better airplane controllability throughout both takeoffs and landings.

Figure 3 shows the improved time to turn with the 6-3 slatted leading edge at an altitude of 45,000 feet and .86 indicated Mach. For example, a turn having a radius of 21,500 feet can be made in 41 seconds at 1.45G with either the standard or the 6-3 slatted leading edge. This turn is a maximum usable G turn with the standard F-86D wing (old type slatted leading edge). Under the same conditions with a 6-3 slatted wing, a 90-degree turn can be made at 2G with a turn radius of 12,000 feet and an elapsed time of 23 seconds. For small course corrections, a usable G of about 2.5 to 3G is available.

Dan Darnell is an engineering test pilot at North American Aviation, Inc. Currently engaged in the flight test program on F-86H and F-100 series airplanes, he has taken part in the testing of all the F-86 series during his six years with North American. Prior experience includes flight testing in the USAF Flight Test Division, Wright-Patterson AFB.

It looks good on paper, but how is it up in the air? We took a 6-3 slatted leading edge F-86F to 45,000 feet with a solid leading edge "F" in the trail position. Altitude was held constant, and in about three 360-degree turns, the slatted leading edge airplane was in firing position on the other. While tracking a solid leading edge airplane that was pulling maximum G, I actually executed rolls inside his turn radius.

To completely evaluate solid and slatted leading edges, pilots were alternated. At no time was the slatted F-86F outperformed in any maneuver that the solid leading edge airplane could execute. At no time was the pilot of the slatted leading edge airplane outmaneuvered in simulated combat.

Being involved in this project has been one of my most satisfying experiences. Here, a minor and not too costly change greatly improved the combat capabilities of an airplane, as well as reduced the hazard of flying. What more could be hoped for?

The new slats will be added to F-86 airplanes in the near future. Here's hoping that you soon get a chance to fly one of these modified birds. ●

WELL DONE

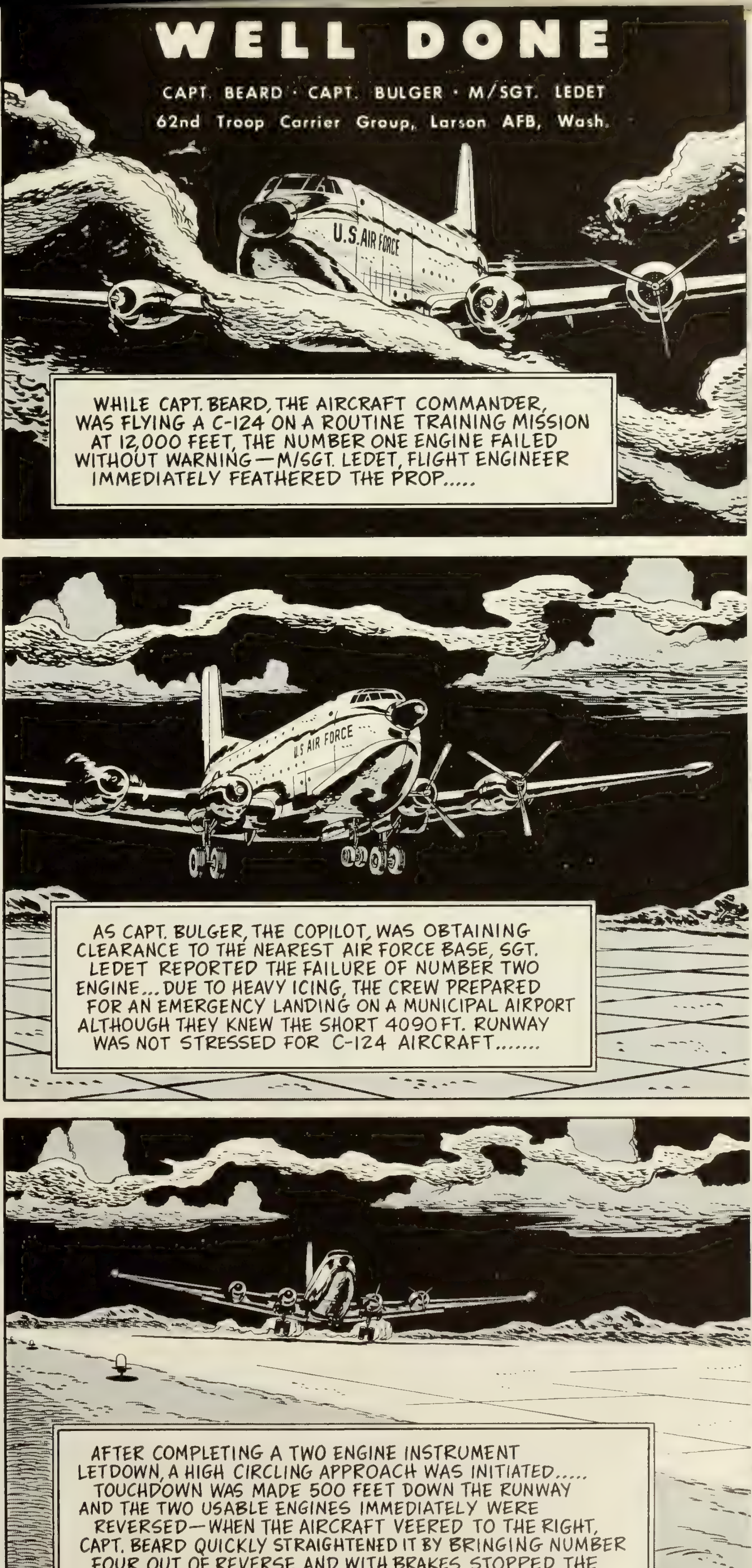
CAPT. BEARD · CAPT. BULGER · M/SGT. LEDET

62nd Troop Carrier Group, Larson AFB, Wash.

Captain Frank F. Beard

Captain Arthur R. Bulger

M/Sgt Louis L. Ledet


U.S. AIR FORCE
WHILE CAPT. BEARD, THE AIRCRAFT COMMANDER, WAS FLYING A C-124 ON A ROUTINE TRAINING MISSION AT 12,000 FEET, THE NUMBER ONE ENGINE FAILED WITHOUT WARNING—M/SGT. LEDET, FLIGHT ENGINEER IMMEDIATELY FEATHERED THE PROP.....
U.S. AIR FORCE
AS CAPT. BULGER, THE COPILOT, WAS OBTAINING CLEARANCE TO THE NEAREST AIR FORCE BASE, SGT. LEDET REPORTED THE FAILURE OF NUMBER TWO ENGINE... DUE TO HEAVY ICING, THE CREW PREPARED FOR AN EMERGENCY LANDING ON A MUNICIPAL AIRPORT ALTHOUGH THEY KNEW THE SHORT 4090 FT. RUNWAY WAS NOT STRESSED FOR C-124 AIRCRAFT.......
AFTER COMPLETING A TWO ENGINE INSTRUMENT LETDOWN, A HIGH CIRCLING APPROACH WAS INITIATED..... TOUCHDOWN WAS MADE 500 FEET DOWN THE RUNWAY AND THE TWO USABLE ENGINES IMMEDIATELY WERE REVERSED—WHEN THE AIRCRAFT VEERED TO THE RIGHT, CAPT. BEARD QUICKLY STRAIGHTENED IT BY BRINGING NUMBER FOUR OUT OF REVERSE AND WITH BRAKES STOPPED THE PLANE 800 FEET FROM THE END OF THE RUNWAY.... SKILLFUL HANDLING AND PROFESSIONAL TEAMWORK REALLY PAID OFF!

REX SAYS

AFTER TAKEOFF from a small civilian field, the pilot of a Gooney Bird noticed that the airspeed indicator wasn't doing business. He and the crew chief discussed the situation and decided that the pitot cover had not been removed. The latter suggested that mayhap a bit of heat in the pitot head might burn the cover off. It didn't.

The driver then decided to attempt a landing. This didn't meet with any great amount of success as the old Gooney got to bouncing and, as the pilot zigged when the plane zagged, the porpoising action got pretty severe. Finally the throttles were opened and at this point the pilot decided to continue on with the flight as planned.

After about two hours of flying through heavy turbulence the plane was brought in for an emergency landing. This time the touchdown was successful. The crew had had enough.

Getting back to the beginning of this little fiasco, the pilot had instructed the crew chief not to remove the rudder lock until he was in the cockpit and holding the rudder pedals. The pilot made a quickie-type walk around and leaped aboard. The airman was stationed by the tail. Nobody remembered the pitot cover.

REX SAYS: This is hardly worth commenting on. This lad must belong to the old school of tire-kickers, though fortunately there aren't many of them around any more.

★ ★ ★

I'M AN IP in F-84s and have better than a thousand hours in the bird. I think I have a fair idea of the systems and know pretty well when a plane is safe to fly and when it isn't. Ordinarily, if there is a question in my mind about the aircraft, I check with the crew chief and get his opinion. But recently I ran into a situation that really stalled me out.

During the preflight inspection of my assigned aircraft I noticed hydraulic fluid seeping from the dive brake well. Also I noticed that the locking nut on the main fuel connection in the well was loose. I wrote up the discrepancies, accordingly. As I was making out the write-up, the crew chief came up and told me the plane was okay. He said the hydraulic leak was either mild seepage or fuel spilled during refueling operations. He wasn't sure just which it was, but shrugged it off and claimed the plane was ready to go.

I didn't argue with him; just got the maintenance officer. Seems I was right and the sergeant was wrong. There was a leak. The point is, the crew chief might have persuaded a student or an inexperienced pilot to go ahead and leap off. I might add the crew chief got racked back, but good.

REX SAYS: Well, that's an interesting switch on the old "But I'm not the regular crew chief" story. I don't know if the sergeant was lazy, careless or just plain stupid, or a combination of all three, but I'm glad to note that he is in a small minority.

If you believe that something is wrong with your aircraft, stay on the ground until you find out for sure that it is all right. Taking someone else's word that a discrepancy is minor or of no importance is sticking your neck way, way out. And, brother, it's your neck, not his.

★ ★ ★

I'M NOW a firm believer in the scoop that is contained on page 173 of the Supplementary Flight Information Document. It also appears in the Special Notices section of the Radio Facility Charts. I guess a guy has to get lost to appreciate the safety procedures outlined on these two pages.

I was tooling along at 35,000, minding my own business, when the UHF went dead. I'd slipped a mental cog and hadn't really kept up with navigating. Besides this, the petrol was running close, so there was no time like the present to try this radar intercept that we'd discussed at yesterday's Flying Safety meeting.

I flipped the IFF switch to emergency, flew the required pattern, then took off on a bee-line to my alternate. There I received letdown instructions on my radio compass because the lads on the ground were all prepped for me, and I made a normal letdown and landing.

I've covered about an hour's possible sweat job in two paragraphs. My flight could have resulted in a serious consequence wherein I might have had to walk home. As it stands now I am a 100 per cent booster of a pilot knowing his emergency radio procedures thoroughly.

REX SAYS: Instead of being a headline in a newspaper, this pilot showed what good, intelligent use of the printed material available to every pilot will do. Summed up, all is not lost when lost.

★ ★ ★

I WENT out to my F-94C t'other day and after making the walkaround, climbed in and got ready to crank up. In checking the controls for freedom of movement I found that the rudders were binding. I did some fast checking and, lo and behold, fished out a foot-long wrench from the right rudder well. Things like that tend to shake a man's faith.

REX SAYS: Don't hardly know what to tell you. Sounds as if you have a first-class Airman Lou Snutt in your outfit. Just goes to show what a good preflight can turn up on occasion.

THERE ARE BIG guys and there are bigger guys, but I drew the biggest one of all as my copilot in a C-47 not too long ago. We were scheduled for a CRT flight and everything went okay until we returned to the field to shoot a landing or two.

We cranked into the pattern and flew an uneventful downwind and base, but after turning on final we ran into some severe jet wash. We were at about 300 feet when we smacked into the turbulent area and I had to apply considerable left aileron to keep the wings level. I got the wing up okay but when I tried to return the wheel to neutral, nothing happened!

I tried again, a little harder, as the plane started to go into a descent to the left, wing low. By now things were getting somewhat shook in the cockpit; it looked as if we were going to prang, but hard. I made one last attempt, using all my strength to pull back on the wheel and turn it to the right, with full throttle applied.

This time I was successful. The wheel returned to neutral and we leveled out and started a go-around. Out of the corner of my eye I noticed that as the wheel came back, the copilot's left leg rose into the air with it. Yeah, you guessed it. Old king-size had the wheel caught in the knee pocket of his flying suit. That meant that when I turned the wheel back to neutral I was lifting a goodly portion of a large hunk of man. My boy had neglected to adjust the seat and rudder pedals and hadn't allowed sufficient clearance between himself and the controls.

Rex feels that to be a proficient pilot you must be a well-informed pilot. Often Rex runs across small, but important, changes that should be brought to your attention. Rex's review of accident and near-miss reports indicates that occasionally there are certain aspects of flying about which pilots need reminding. In an effort to keep you informed, he will, from time to time, carry current, informative items on this page to keep you, the professional pilot, up to date.

* * *

IN THIS FLYING business there are many emergency situations that often result in a substantial amount of wear and tear on pilot and machine alike. Some of them result only in mental anguish while others can give you a few lumps. But, if you have ever been involved in a mid-air collision, and survived, I think you will agree . . . they are the hairiest of them all.

Now maybe this isn't news to anybody, but guys are still roaring around the area, ricocheting off other flying machines. Most of all this happens during VFR flying and a large majority of it occurs in or around highly congested areas. Things get real exciting in an area where everything from B-52s to Cubs is cluttering up the atmosphere. Unless you really keep your eyeballs uncaged and your head on a swivel, coming nose to nose with another airplane is no trick at all.

With an increase in reported mid-air collisions and near-misses, the Civil Aeronautics Administration has launched a "Mid-Air Collision Avoidance" program. A poster campaign is already under way designed to remind pilots of the ever-present collision hazard. In addition they have undertaken some rather interesting projects within congested areas, on an experimental basis. One such project governs VFR flying in the Washington, D.C. area. (See Keep Current section, FLYING SAFETY, Sept. 1955.) This test will be concluded on 24 November and an evaluation will be made as to feasibility for adoption within other high-density zones.

Also, a "heavy traffic warning signal" test is soon to get under way in both the Washington, D.C., and the Los Angeles areas. When you are tuned to a Navaid in these areas and hear a transmission such as "Caution—Congested Traffic," consider yourself warned.

Let's everybody get behind this "Mid-Air Collision Avoidance" campaign and remember these basic rules:

- During VFR always keep looking around.
- Off airways, fly the correct quadrantal altitudes.
- On airways, fly the correct airways altitudes.
- Be especially alert in and around congested areas.

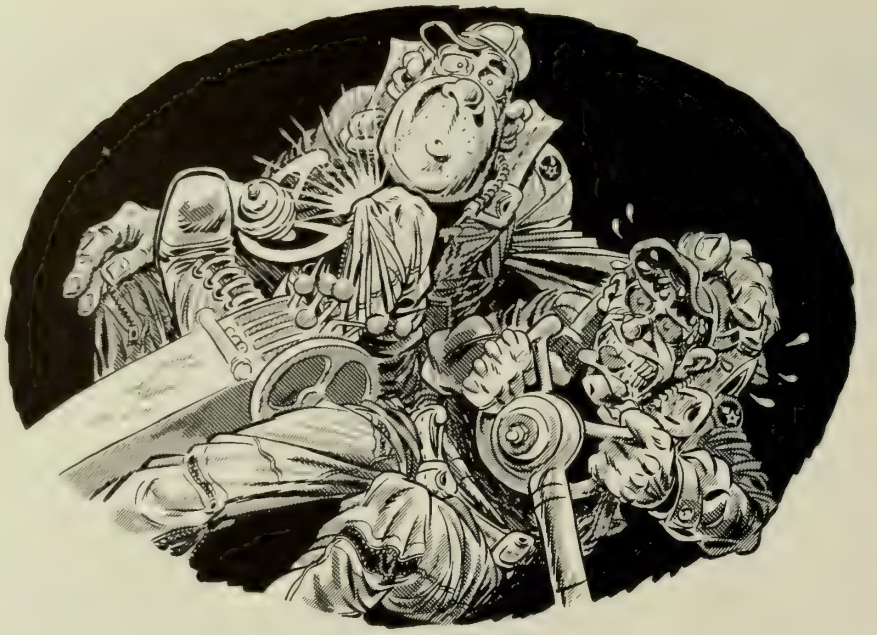
* * *

I RAN ACROSS a couple of interesting items that I think should be brought to your attention.

The first one is on IFR position reporting procedures. It seems that CAA stations have been receiving some real "gone" position reports of late.

Giving the man all kinds of unnecessary information such as your point of departure, point of destination and type of airplane only clutters up the air. It serves no useful purpose to ARTC. The required information is this, no more or less: (1) Identification, (2) Position, (3) Time, (4) Altitude, (5) Type of flight plan, (6) ETA next reporting point, (7) The name *only* of the next succeeding reporting point along the route of flight, and (8) Remarks, when required. Here's how your position report should read when operating on Victor Airway 30, Pittsburgh to Minneapolis: "Air Force six two one eight five, over Litchfield five six at eight thousand, instrument flight plan, estimating Pullman one four one eight, *Milwaukee*." This is all explained in the FAC chart. See the inside back cover.

The other item deals with flying IFR on Victor airways. Pilots flying IFR along such airways are cautioned to make every effort to stay in the center of the airway. It is possible that in areas where adjacent Victor airways are separated by only 15 degrees, other traffic can be operating along these airways at the same altitude or climbing or descending through your altitude near congested terminal areas. Enough said, I'm sure. ●



Yep, old king-size had the wheel stuck in the knee pocket of his size 48 flying suit.

REX SAYS: Sort of lucky your copilot wasn't lead-footed, to boot. What amazes me about the whole deal is that the big fellow must have been slightly uncomfortable during the entire flight. Actually, more than one accident has been caused by someone who failed to fit himself or his equipment into the cockpit with sufficient control clearance.

★ ★ ★

I THOUGHT you might be interested in this account of a board investigation into a violation of flying regulations. It is astounding that any pilot would take off on a cross-country with the complete lack of flight planning that this one displayed. A narrative of the incident follows:

The flight started from a civilian field located in a western state. The pilot filed with CAA while the copilot was briefing the passengers and inspecting the aircraft, a B-25. After the engines were started the copilot asked what their destination was and the pilot informed him that they were going VFR direct to a base in the Middle West.

The copilot then reminded him that this meant they would be flying over high, mountainous terrain at night and suggested that they go airways. He received no reply. They took off and the pilot cranked in a station on the bird dog that took them considerably south of their filed course.

They flew this course for about 30 minutes, ending up about 80 miles south of course. The copilot finally was able to convince the pilot of their approximate position and that they were now on airways. The pilot shrugged this off as being unimportant, although they were approaching an ADIZ. Further, he refused to make a position report and an estimated time and place of penetration, stating that *it was not required when entering an ADIZ, but only when leaving one at an altitude above 10,000 feet.*

During the flight it became obvious that the power settings used would not allow the aircraft to reach the original destination. The pilot called a base and requested landing instructions, receiving a straight-in approach. About the time that he started his letdown, two F-94s bounced them. Fortunately, it was obvious that the plane was landing, so the fighters allowed them to go on in. Needless to say, there was quite a reception committee waiting on the ground for the plane to taxi in.

The copilot stated that he had performed all the navigation on the flight out and had tried to keep up with their position on the way back. This was a little hard to do, however, as the pilot had neglected to pick up any charts covering his filed flight plan. The Fac Chart was the only available navigation aid for the trip east.

The investigating board found that this violation submitted by Flight Service was valid and that the pilot used little or no preflight planning.

A further finding was that the evasiveness used by the pilot in answering questions submitted by the board during the investigation indicated a lackadaisical attitude on the pilot's part toward complying with flight regulations and accepted rules and procedures.

REX SAYS: This one is the bitter end. I concur with the board findings and think that under the circumstances the language was rather mild. The last time this lad checked 60-22 must have been back in the Jenny days. As for his non-existent flight planning, I don't think it is necessary to make any comment on that. You can sum up the whole mess by saying that this guy just wasn't a professional.

★ ★ ★

I THOUGHT Rex would appreciate this little hide and seek episode. It's one for the books.

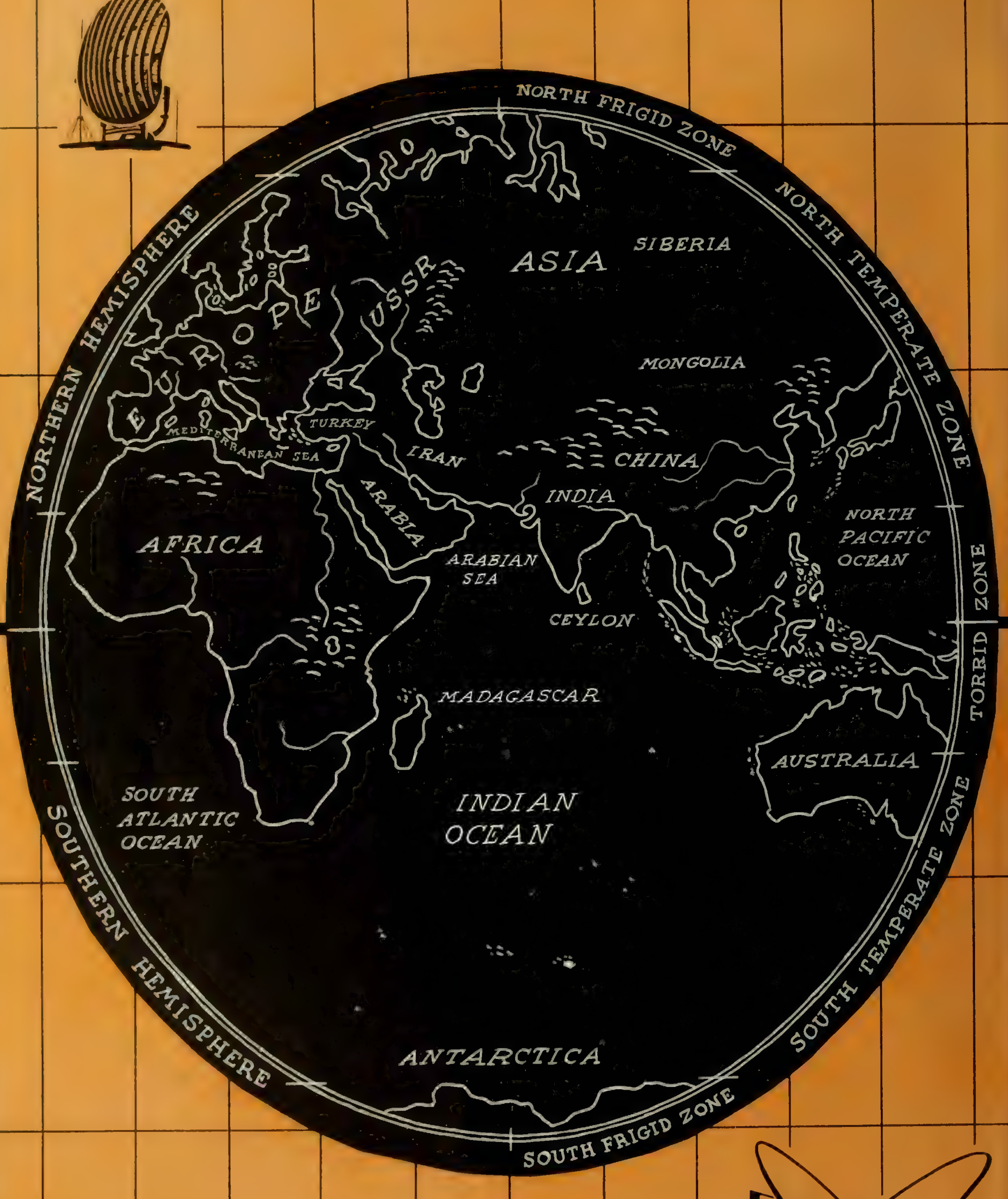
Flight Service received a call from an Air Division stating that a Mayday was being received from an Air Force jet, but that they did not have radar contact. Immediately all DF and radar facilities in the area were alerted. Two DF units were able to obtain bearings which were plotted by Flight Service. An advisory was issued to the pilot who then stated that he was running low on fuel and was at 5000 feet. Flight Service advised him to climb, due to terrain features and for better radio reception. This did the job and the aircraft was directed to an air base for a safe letdown and landing.

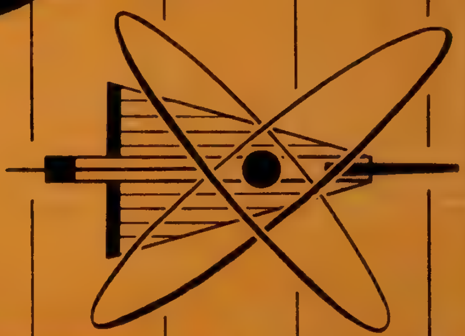
What makes this whole caper especially interesting is the fact that this was the third time in two days this pilot had become lost and squawked "Mayday." And in the same area.

REX SAYS: This is a boo-boo from the records that makes for hard believing. Navigation, either by pilotage or radio aids, isn't a lost art. For a pilot to goof up once is bad enough, but to get hopelessly lost three times in two days in the same area, well. . . . I wonder if this lad had any business in a jet aircraft?

Snow is where you find it . . .

This unusual winter scene should have a message for you. Weather phenomena is at its peak during the coming months, so don't be a winter mishap because of unsuspected conditions. Before every flight, double-check the latest weather trend and read those NOTAMS.





U. S. GOVERNMENT PRINTING OFFICE . . . 362328

629.1305
FLYS

FLYING SAFETY

DECEMBER 1955

UNITED STATES AIR FORCE

FLYING SAFETY

VOL. ELEVEN NO. TWELVE

● For a complete rundown on the Air Force's airborne detectives, be sure to check the article entitled, "The Sky Is Their Beat."

● There are some rather pointed reminders for you hard hat heroes on page 9. If you're having snap trouble, better read it twice.

● For those who find the paint on the pavement confusing, we've got "Runway Warpaint."

● As strong exponents of fair play, we believe that both sides of any question should be heard. In this case, we went down to a tower and got the word from the boys in the greenhouse.

Next month, our feature story will introduce you to the supersonic Super Sabre.

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

STAFF

Editor
Major Perry J. Dahl

Associate Editor
Maj. Jesse F. Townshend, Jr.

Managing Editor
Captain John H. Moore, Jr.

Art Editor
M/Sgt. Steven Hotch

PRODUCTION

Major Ben H. Newby
T/Sgt. Nicholas Shekita, Jr.

T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune

T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

Page

Crossfeed 2
The Sky Is Their Beat 4
Snap That Strap 9
Runway Warpaint 10
From Spangdahlem to Kisarazu 12
New Defense Areas and ADIZs 14
Chatter From the Fishbowl 16
Well Done 21
Rex Says 22
Well Done 25
Annual Index 26
Send a Letter 28

★ ★ ★

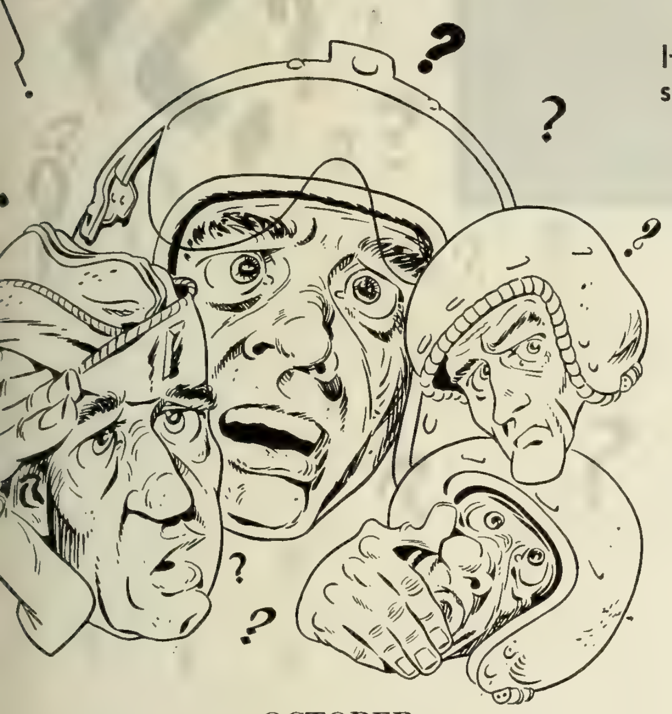
SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

How Well Can You Remember ?

If you miss more than four, better thumb through some back issues. And don't peek at the answers.



OCTOBER

1. What new features have been added to the revised Air Force altimeter?
   - a. *10,000-foot needle triangular extension and striped warning area.*
   - b. *A roller drum and a striped warning area.*
2. How does a pilot recognize the back or low side of the power curve while flying?
   - a. *Decreased airspeed and increased rate of sink.*
   - b. *Decreased airspeed and decreased rate of sink.*
   - c. *Abrupt stall.*
3. When taxiing on icy surfaces in multi-engine aircraft, which of the following techniques is recommended?
   - a. *Use of brakes.*
   - b. *Use of throttles.*
   - c. *Use of snow-grip tires.*
4. To detect ice accumulation on jet engines during winter operations while in flight, which instrument will give the most rapid indication?
   - a. *Tailpipe temperature gage.*
   - b. *Free air inlet gage.*
5. A handy-dandy kit for administrative pilots to carry during winter flying should contain:
   - a. *Rifle, fishing tackle and bedroll.*
   - b. *Long underwear and high boots.*
   - c. *Knife, signal mirror, matches and flashlight.*

NOVEMBER

6. Crews of the 374th TCW are checked by the standcrew:
   - a. *Each month.*
   - b. *Annually.*
   - c. *At least each six months.*
7. Above 25,000 feet and faster than .65 Mach, the 6-3 slats on the F-86 provide:
   - a. *More usable G than the old type slats.*
   - b. *Less maneuverability.*
   - c. *More buffet.*
8. When should an F-86 gear be retracted during a minimum-run takeoff?
   - a. *Immediately.*
   - b. *After acceleration to normal takeoff speed given in Dash One.*
   - c. *Not below 500 feet.*
9. What is the best source of information on available flight charts and publications?
   - a. *USAF Catalog of Aeronautical Charts and Aeronautical Information Publications.*
   - b. *U. S. Geodetic Survey.*
   - c. *Any base operations section.*
10. By what means was some suspected fuel tested by the C-124 pilot at Saigon?
    - a. *Tested its liquid quality between his fingertips.*
    - b. *Obtained a sample in a glass jar, agitated it and watched its settling action.*
    - c. *Checked with driver of truck as to source of fuel.*

DECEMBER

11. The main difference between the P-1A and the P-3 protective helmet is the addition of a visor.
    - a. *True*
    - b. *False.*
12. What is the letter code used on the Form 175 to denote you will discharge cargo at your destination?
    - a. *AC.*
    - b. *AP.*
    - c. *DC.*
13. An EC-121 flies at 10,000 feet on an AOC mission to get:
    - a. *Out of icing.*
    - b. *The best combination of communications and radar coverage.*
    - c. *Maximum efficiency from the engines.*
14. Runway distance markers indicate to a pilot the takeoff distance remaining to the end of the runway.
    - a. *True.*
    - b. *False.*
15. In tower terminology, the "idiot perch" refers to:
    - a. *The A operator's station.*
    - b. *The B operator's station.*
    - c. *Giving DF steers to misplaced pilots.*

ANSWERS

1. a	6. c	11. a
2. a	7. a	12. c
3. b	8. b	13. b
4. a	9. a	14. a
5. c	10. b	15. b

LETTERS TO THE EDITOR

More Crystal Headsets

In your April 1955 issue, Lt. Col. Bushue had a note recommending the switch to small crystal-type headsets. I concur with him insofar as the good qualities of the headset, but I would go a step further and recommend the investment of a few more greenies for the purchase of the two-ear headset, (approximately $28.00). A set of this kind is custom-made for each individual.

The plastic earpiece is molded directly from the wearer's ears to insure a comfortable, snug fit. Incorporated in this type of headset is an individual volume control which allows the pilot to adjust the incoming signals to a level suitable to him. How many times have you been blasted out of the cockpit using the old donut ear boxes because the joker sitting in the other seat was deaf and had to run the volume extra high?

With these custom-fitted ear pieces, engine noises can be shut out noticeably. It is presumed that the colonel's one-ear job is interchangeable and thus can be used in the outboard ear regardless of whether the left or right seat is being occupied. When reception is good, we usually fly with the inboard ear-piece in our shirt or flight suit pocket to facilitate conversation within the cockpit. However, when reception is on the poor side and every decibel is required to read the signal or copy the clearance, then using both pieces not only shuts out unnecessary surrounding noises but has two ears working instead of one. Reception is thus greatly improved.

Approximately fifteen Coast Guard pilots have been using the type headset described above for from two to three years and the general consensus among them is that they are the best seen and tried to date for the tops in radio reception.

One other advantage is that it permits the cultivation and growing of hair on the part of the cranium which has hitherto been worn bare by the old fashioned type ear muffs.

LCDR J. K. Rea
U. S. Coast Guard Headquarters
Washington, D. C.

Sounds as if these small, crystal-type headsets are the most. Especially for some of the more skin-headed, long-in-the-tooth plane drivers.

★

Flip Flopped

The article entitled "Hazards or Aids" by Mr. G. M. Kevern in your August issue was much appreciated.

However, I have one question that I believe is worth considering. Was the upper left hand picture on page 3 taken during inverted flight? All Winged Out Threshold light installations that I am familiar with have the three rows of lights on the left when approaching the runway. Also, Figure 8 on page 7 shows the proper manner of presentation, while the picture referenced above shows the three rows of lights on the right.

The most logical conclusion of course is a negative turned upside down. But, will the majority of pilots recognize the slip?

Capt. John J. Dwyer, Jr.
FSO, 605th AB Wg.
APO 406, New York, N. Y.

Our editor in charge of approach lights says you are right. He has never seen a system incorporating three rows on the left side either.

Our editor in charge of selecting photographs says you may be right, but that's the way the photo arrived.

The rest of us agree that in all probability the negative was flopped.

As pointed out in the article, the important thing is to refer to the PHACUS to know what type system is installed. If you know what to expect, the actual type of lighting is of secondary importance.

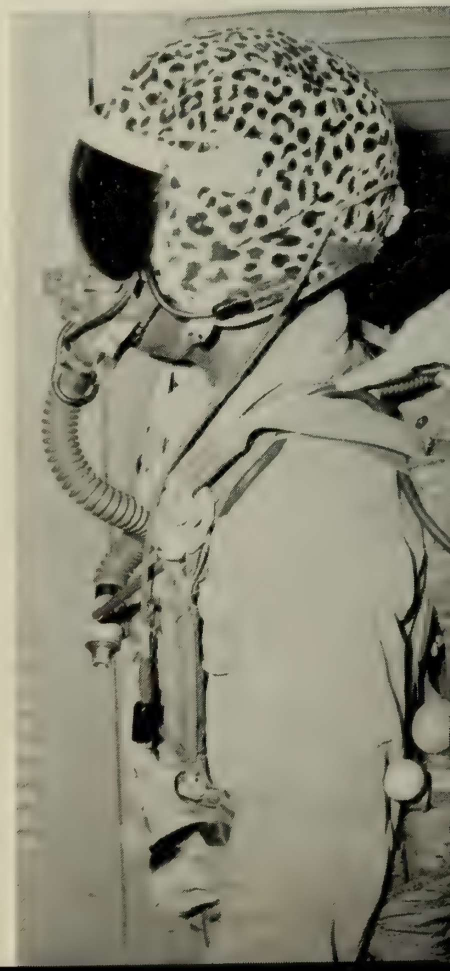
★

the E in P. McCRIPE

Here is a picture showing a procedure that we believe is the best means of routing the long hose from the bailout bottle. It keeps the hose out of the pilot's way, makes for easy hook-up and when original oxygen connections are made, it reminds the pilot of that last letter in his P. McCripe checklist.

We have been using this procedure in our squadron for more than a year and have found no disadvantages or unsatisfactory conditions.

Bailout bottle hose is routed to keep it out of pilot's way and to allow easy hook-up.



We recommend it for Air Force-wide SOP.

Lt. Niles A. Carter
54th FIS, Ellsworth AFB.

This is the way one outfit solved the long oxygen hose problem. Anyone else have any suggestions?

★

Welcome Applause

I want to take this opportunity to express my personal gratitude for the fine job you are doing with the *Flying Safety Magazine.* I find it to be a top aviation publication.

The "Cross Feed", "Rex Says", "Well Done" and "Keep Current" all put across valuable lessons with a punch and yet with a good-natured humor that helps to make the lesson well received.

I like the recurring articles which highlight seasonal problems. They are timely and fresh each year even though treating the same general subjects.

Your special articles on interesting new equipment or important new procedures expand the service rendered by the "Keep Current" series. The recent article by Tony Levier about the hundred series aircraft and the current article on the Zero Reader are fine examples in this line.

Heartiest congratulations on a great publication that is giving outstanding service to the USAF.

Colonel Vincent M. Miles
HQ, USAF

Thank you, sir. We only hope we can continue to live up to your fine words.

★

Snow Removal

Hazards presented by the residual by-products of normal snow removal (snowbanks, ice) result in many accidents every year. With this in mind, it is suggested that an alternative method be considered. If conditions are favorable, the operation of a team of vehicles over the snow-covered runway will induce rapid melting and dispersal of all traces of snow.

The primary decision to utilize the foregoing method may be arrived at by running a vehicle over the runway and inspecting the tracks for melting. This phenomena has no doubt been observed by all persons who have traveled on snow-covered highways.

In the event observed melting action warrants, about 20 vehicles should be marshalled. The drivers should be carefully briefed to exercise driving caution and in particular, to maintain not less than 100 yards clearance between vehicles. The operation consists of traveling up and down the runway in order to spread the melting action by splashing the slush and water over the remaining snow. It has been noted that vehicular speeds of about 30 mph are satisfactory. Depending upon the ground temperature, free air temperature and/or action by unrestricted sunlight, it is possible to substantially diminish or completely eliminate residual snow in this manner.

The foregoing method was successfully utilized to remove a 12-inch covering of snow at Mountain Home AFB, Idaho, with the aid of sunlight but with the free-air temperature below freezing. The runway was completely dry after less than three hours of operation. It also was used successfully at the same base with less snow cover on several other occasions, which invariably resulted in complete elimination of all snow traces on the paved surfaces. Recently it was used at Molesworth, England, with melting action present, temperature at 32°F, and the sky overcast heavily. (The decision to clear snow in this manner was prompted by a forecast temperature of 36°F, which did not occur.) The four-inch covering was diminished in about three hours of operations to a point where the residual snowbanks, following normal plowing operations were less than a foot high on the average. Five vehicles were kept in action during the period.

1st Lt. A. Wisniewski
Hq 582d Air Supply Gp
USAFE

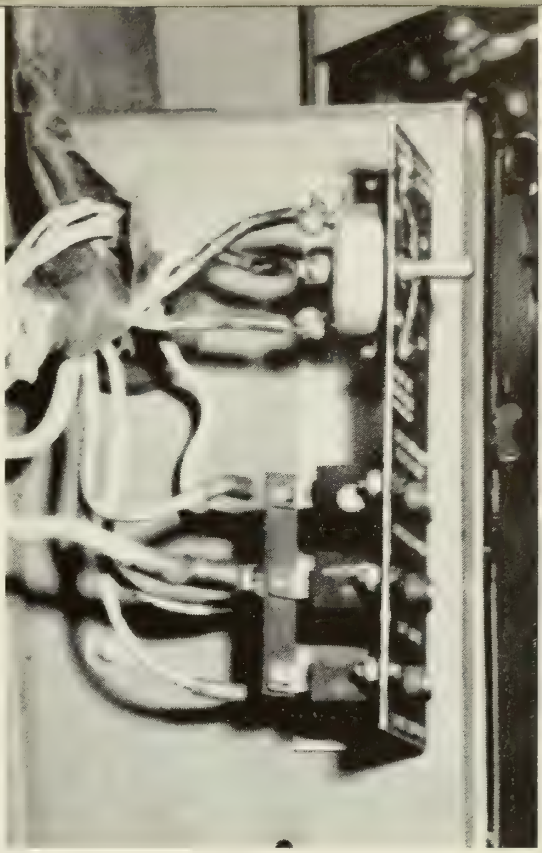
They tell us it works, too! So get out the rolling stock and make like a snow plow.

★

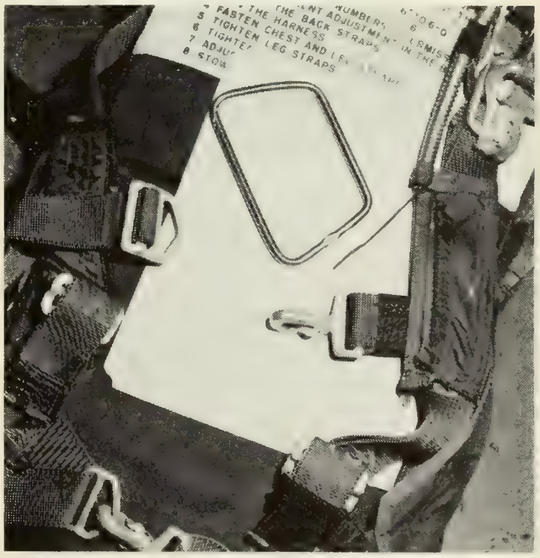
Uncovered Switch Panel

A hazard to flying has come to our attention and I believe it's worth passing on.

A crew member who had been riding in the nose compartment of a B-25 picked up his parachute to slide it through the tunnel to the pilot's compartment, when the ripcord handle came in contact with the rear portion of the bombardier's windshield wiper switch. The ball was completely burned off the ripcord cable which would prevent the "D" ring from performing its intended function of opening the chute. The cable was also burned in another place.



Above, "hot" wires in this uncovered switch panel burned the ripcord cable of the chute, below, and "D" ring slipped completely free.

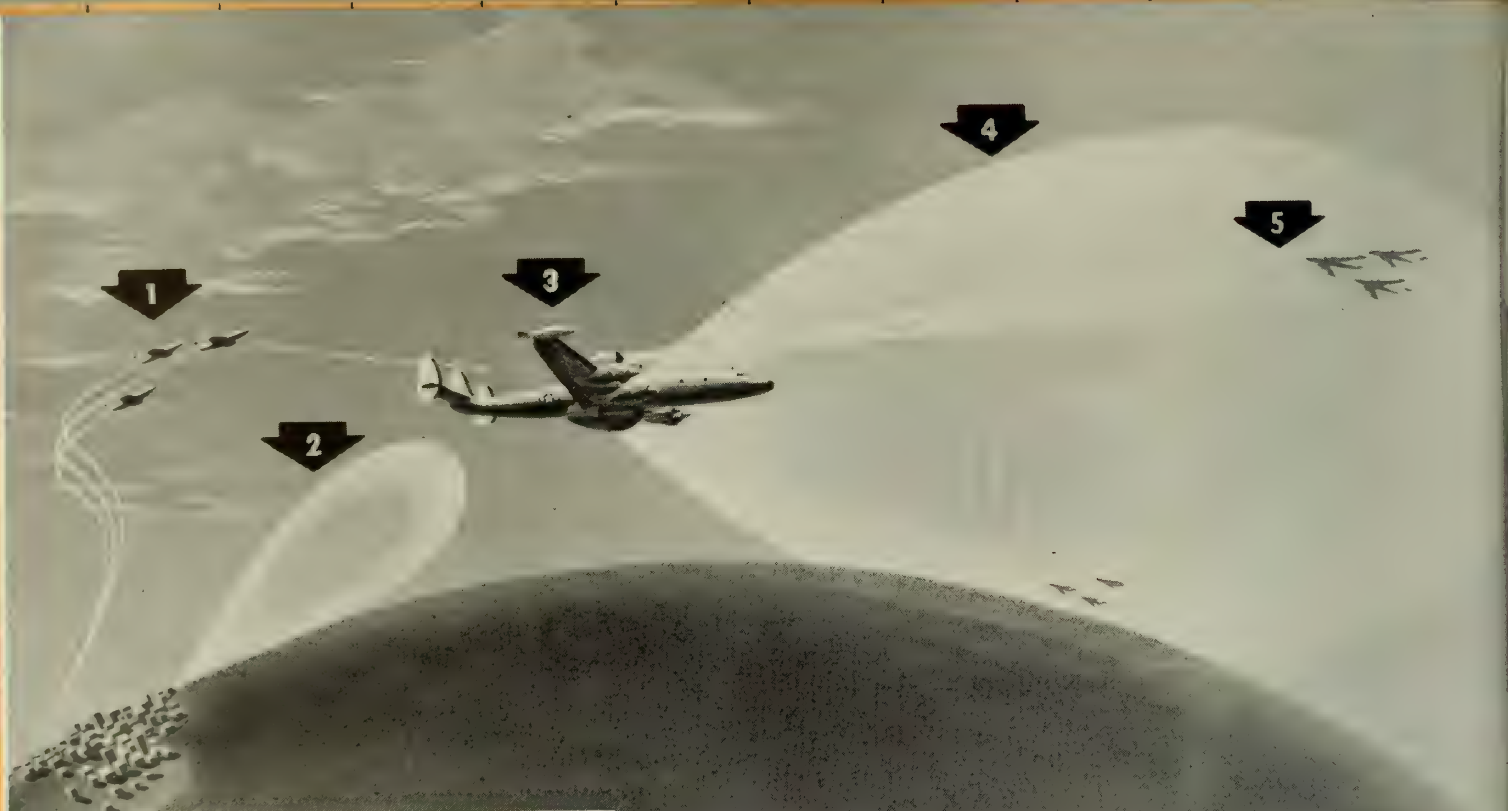


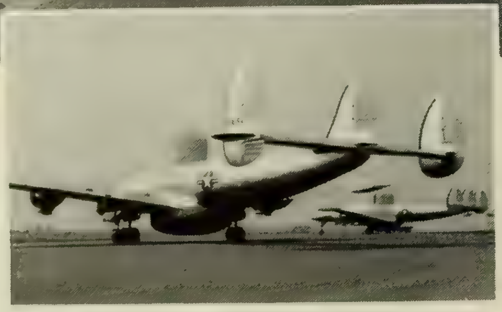
Here are two photographs: One of the damaged chute and one of the uncovered switch panel. The picture of the switch panel was taken from the tunnel looking forward.

A cover has been placed over the switch panel to protect it against inadvertent contact with the "hot" wires.

Capt. Billie J. Wetzel
FSO, 2851st AB Wg, Kelly AFB.

Lucky none of the troops had to use this little dude! We have to admit this is the first time we ever heard of this kind of parachute casualty.





The black radome on the Super Snooper's belly holds a revolving antenna, while the fin-like protuberance houses additional radar.

the SKY i

EC-121 flying radar stations are patrolling our shores on a 24-hour basis. Extra fuel in the tiptanks gives added range and endurance.

CHRISTMAS EVE. A big night for most everyone. To some it means last minute shopping and home to trim the tree; to others it means warmth and light and conviviality; to still others it means church and peace and meditation. But for a relative few, it means increased vigilance, lonely hours, hard work and a bleak night.

These men are in this country's Armed Forces. Their job is to see that this Christmas Eve doesn't differ from those of former years; that it remains a happy prelude to the holiday season.

Many of those maintaining the long vigil are in the Air Force; fighter pilots standing alert, bomber and cargo crews on assigned missions, mechanics and radar technicians keeping the equipment going, large numbers of other back-up men working to keep things functioning smoothly. Finally, there will be several crews of airmen droning around endlessly in strange-looking, humpbacked, pot-bellied aircraft. Theirs is a unique mission—they're the Paul Reveres of the atomic age, riding a metal steed which has electronic eyes, and, if the moment arrives, it's up to them to give the first warning of danger.

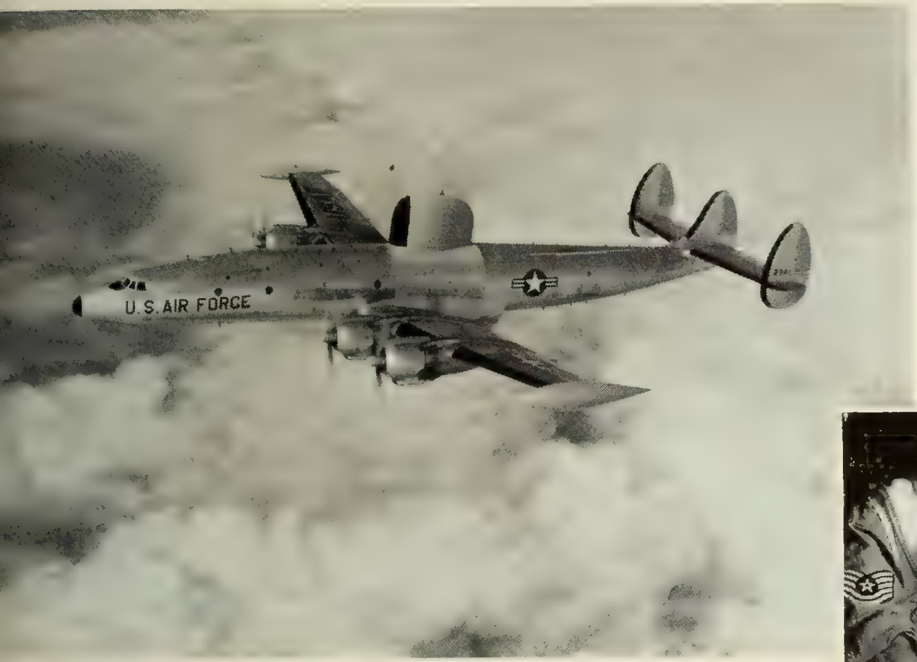
Who are these men and exactly what do they do? A look at their Christmas Eve mission, which is a typical operation, might prove to be interesting.

It's about midnight, and the crew has been airborne for 13 hours. The dark, tunnel-like interior of the aircraft is jammed with equipment which emits a weird glow. Anyone familiar with a GCI station would probably recognize the set-up at once. The hunched figures bent over the glowing screens are scope men, and this is nothing more or less than an airborne radar station.

The men on this Christmas Eve mission are flying in an EC-121 out of McClellan AFB and are part of the 552d Airborne Early Warning and Control Wing of the 8th Air Division (Defense).

Most Air Force people have become

Artist's concept of the all-weather EC-121 in action shows (1) defending fighters answering early warning call of aircraft; (2) ground radar, limited by horizon, operating to pick up planes that might penetrate outer net; (3) the flying radar station at an altitude which permits looking over the horizon; (4) huge search area covered by radar installed under plane's belly, (5) height-finder radar operating from the tall, narrow dome mounted on the top of the fuselage.



Crew training continues to play an important part in the wing's program. Tactics and SOPs are being developed through experiments.

Their Beat!

familiar with the Super Connie that is vaguely reminiscent of a large, pregnant duck. Also, they usually know that the big bird is some kind of a flying radar station, performing patrol duties somewhere over the ocean. Fundamentally, this concept is correct, but it has some rather interesting ramifications. Anytime you take a relatively new airplane, blend in an all-weather operation and mix it all into a new defense concept, you come up with some rather unusual problems.

But to get back to the typical mission. This crew will fly for 15 hours over a pre-designated course at an altitude of 10,000 feet, about 150 miles from shore. The radar operators share a responsibility with ground radar stations of detecting aircraft penetrating our coastline.

Those familiar with the commercial version of a Connie wouldn't recognize the inside of this bird. From the aft door all the way forward to the pilot's compartment, the fuselage is crammed with radar scopes, radios, bunks, ovens, sinks, tables and even a few upholstered, fat cat airline seats. There is plenty of walk-about room for the crew, but still, the overall effect is that the plane is bursting at the seams. It takes but one glance to see that the interior of this aircraft is filled in each nook and cranny with equipment.

The three assigned pilots alternate flying the plane on a designated track between two established points. The navigator feeds them headings to crank in, allowing for drift, so that the plane doesn't deviate from the assigned course. The engineers and radiomen both have a long haul. Their respective equipment must be monitored closely during the entire flight. The senior director, in charge of the "radar room," and his radar operators alternate at the search scopes at least once an hour; longer periods of concentrated staring reduce a man's efficiency at a rapid rate.

The senior director is responsible for transmitting the air surveillance information rapidly and accurately to the Direction Center on the ground. The radar scopes visually present the

". . . dark, tunnel-like interior of plane is jammed with equipment which emits a weird glow."

Headings must be plotted constantly, allowing for drift, to keep the plane on course.

AOC missions mean a long haul for radio men. Radios must be monitored at all times.

air situation in such a way that the senior director can evaluate it for control and reporting purposes.

At least six radar operators are required to man an Airborne Operations Center. Two off-centered PPI scopes are used for detection, tracking and direct telling of information to the Direction Center. A third PPI scope is monitored by an air surveillance supervisor who acts as system coordinator, while the other three men fill in on the height finder, plotter and recorder positions.

The scope operators call in blips or paints which appear on their screens to the supervisor who assigns them a number. After the new paint has been established definitely, its direction, time of discovery, location and estimated number of aircraft are called in to the Center. A typical call might read, "New track, Nectar three three, at one eight five, range eighty, southwest, time five four."

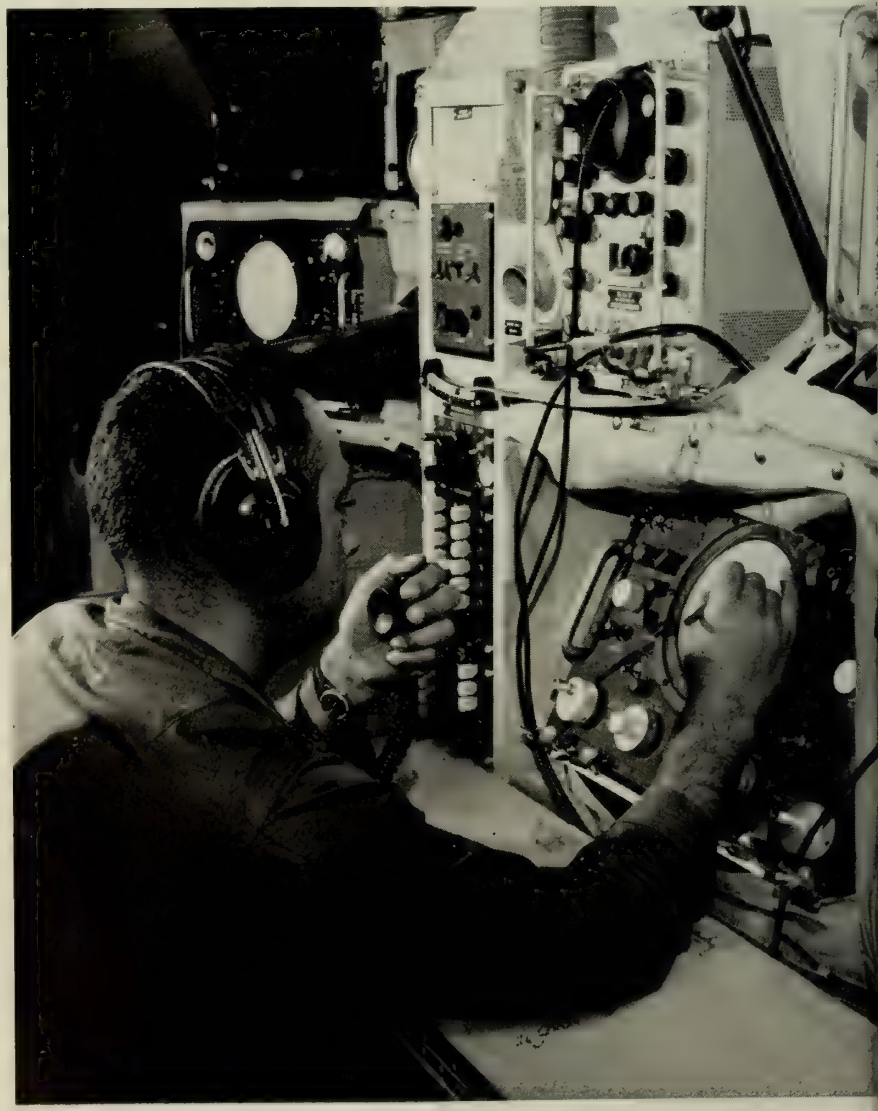
An interesting facet of an AOC is that each aircraft carries two technicians who perform on-the-spot maintenance on the radar equipment. Although hampered by a lack of proper test equipment, which is being developed for the Air Force by manufacturers following AEW&C specifications, these men manage to maintain a high in-commission rate. And it goes without saying that they perform their jobs usually under adverse conditions at best.

After running through this Christmas Eve mission, it might be well to take a look at the unit responsible for it, and to learn something of the duties, over-all Air Force mission and how it is accomplished.

The 552d AEW&C Wing is at present partly operational and partly in a training status. Many of the wing procedures are undergoing constant revision and rewriting as the unit learns through experience. The wing is composed of five squadrons; two flying operational missions, one each for training, maintenance and electronics.

The concept of Airborne Operational Control, with its increased early warning capabilities, is new and the equipment and techniques are still in the development stage. Consequently, the all-weather AEW&C units have had to come up with some fancy-Dan flying safety techniques and SOPs.

Great emphasis is placed on the requirements for check-out as either an IP, pilot or copilot. To become an IP, a pilot must have 3500 hours total time and 500 hours of four-engine time, or 2500 hours total and 1000 hours of four-engine time, plus 100 hours of EC-121 time. To check out as a first pilot requires 2000 hours total time and 200 hours of four-engine time or 1500 hours total and 400 hours of four-engine time, of which 100 must be in an EC-121, plus 100 hours of night and 100 hours of instrument time. Other requirements include passing a tough instrument course which emphasizes various letdown and low approach techniques,



Sitting at the master radar scope, senior director coordinates search work of radar observers.

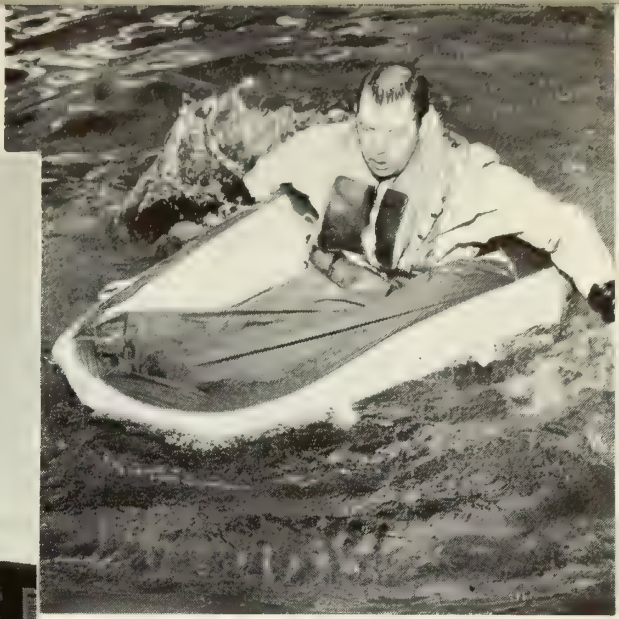
written exams, a checkout on the flight engineer's panel and ground school on the aircraft. Copilot requirements include a minimum of 500 hours total time, 18 hours flying in an EC-121 with an IP, written exams, check-out on the engineer's panel and ground school training.

All crewmembers must fly with the stand-board crew at least once each six months, and many of the present operational procedures and techniques have evolved from these rides. Emergency procedures and instrument work, particularly VOR and ILS, are stressed.

The emphasis on weather is fully justified. This is an all-weather outfit that sees plenty of it, especially in winter. As a result, all pilots in the wing attend a special winter weather course each year just about the time that football season comes in. Most of the AOC flying is done at 10,000 feet, as this has been found to be the best altitude for both communications and radar coverage. In the area where they operate, this means that the aircraft will pick up plenty of ice all winter; in fact, it is not unusual for a plane to come home looking like a flying iceberg.

A new radar observer receives intensive OJT before manning a scope on AOC missions.

". . . scope operators call in blips or paints to supervisor who assigns them a number."



". . . crewmembers must go through the practice ditching course and demonstrate that they are able to use their flotation gear."

Part of this is due to the mission, believe it or not. To get maximum radar coverage by utilizing fully the giant sweep antenna carried in the plane's belly, the EC-121 must be flown at a 4.5 to 6-degree nose-high angle of attack when on station. Consequently, ice tends to form rapidly in areas where present de-icing equipment cannot break it off. Last winter, one pilot picked up so much ice on the underside of his aircraft's wings and fuselage that it stalled out. A gradual descent had to be made to 3000 feet, where the pilot was able to hold altitude until the ice melted.

Another problem, or rather a trio of closely related problems, in the flying safety field involve crew fatigue, heat and vibration. Various length missions are still being flown to establish the best combination of crew efficiency and maximum utilization of the equipment on station. The number of relief people needed for each mission also still is unsettled. At present three pilots, two navigators, two engineers and two radio operators are carried, plus three directors and six radar operators, two radar technicians and two passive detection men.

After the electronic equipment has been in operation for a while, the cabin temperature starts to move skyward; high cabin temperatures are standard for most long flights. This, too, contributes materially to crew fatigue. The aircraft's cooling system just can't handle all the heat generated at present, but new equipment now being developed will alleviate this situation. Vibration, the third contributor to over-all fatigue has been lessened to some degree in the newer model planes and it is hoped that the manufacturer will be able to reduce it further on new planes.

To combat crew fatigue, crewmen who come off duty are required to rest. No reading, card playing or bull sessions are allowed. These men hit the sack, which is far more comfortable than a lot of GI types and can be curtained off to enable even the lightest sleepers a chance to conk out. Hot coffee is always available and a complete hot meal is served at regular dining hours, thanks to specially prepared dinners which can be heated in the airborne ovens.

While on AOC, the EC-121 has direct communications with the 8th Air Division Operations Center and the maintenance section. This system has paid dividends several times. The Ops Center keeps a close check on the weather and can select an alternate and give it to the AC while the plane

Meals are precooked on the ground then heated during the flight in the airborne oven.

Chow is good aboard the big birds. Crew is served a complete, hot meal during mission.

Plenty of hot coffee and comfortable lounge help the crew to relax during long missions.

is still on station. In the case of mechanical difficulty, the maintenance section can be read in and is able to give advice to effect a fix.

Another angle, which the 552d believes will contribute to flying safety, is that of crew integrity. At present, only the aircraft commanders and two flight engineers fly as a constant crew, but the eventual goal, as soon as the wing progresses out of the training stage, is to have the entire crew, including the radar operators, form a complete team.

Comprehensive briefings, both preflight and post-flight, play an important part in the safety program. Mission briefings are given by the aircraft commander, navigator, senior director and the engineer. Emphasis is placed on ditching positions and evacuation of the aircraft. All crewmembers must go through the practice ditching course and show that they are capable of using flotation equipment correctly.

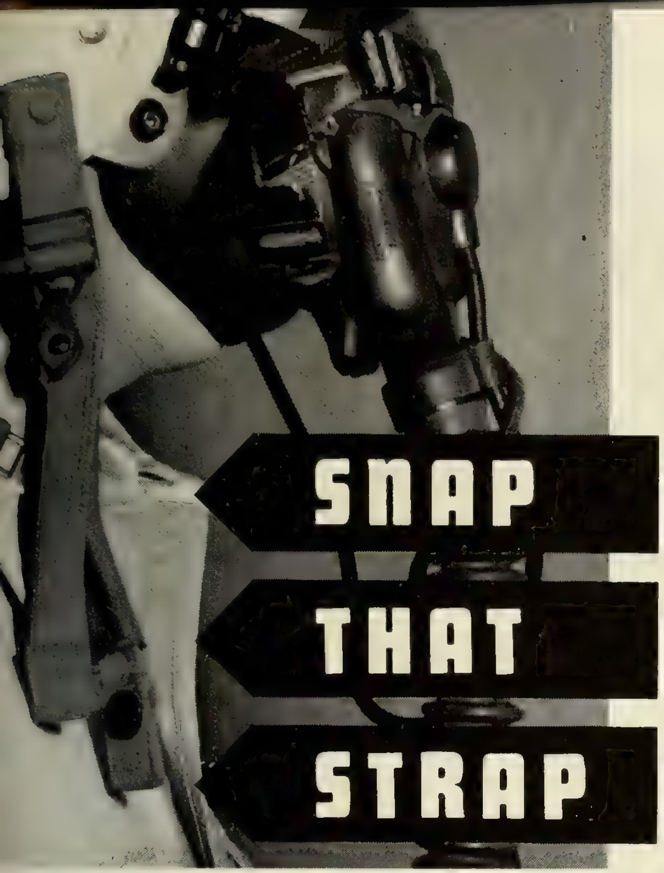
Col. R. W. Davania, 552d Wing Commander, in discussing the wing's present status stated, "Although we are now operating on a seven-day week, 24 hours a day, we consider ourselves to be in more or less of a training status. Our training is aimed at finding out the best ways for these planes to operate. In fact, our EC-121 tactics and procedures have been, and will continue to be developed through our training program. This is a new concept and we have no past experience from which we can get assistance. Since we have been in operation we have learned a lot, but through experimentation and experience we are improving daily, and we intend to keep on doing so."

Col. Davania believes the future possibilities of this operation are practically unlimited. "We can act as an airborne radar aid in bad weather and assist aircraft in for a landing in case a ground station goes out. In the future we expect to be used as navigational aids for long range fighters on either tactical or ferrying missions. We can visualize the day when we can provide a strong, puncture-proof net at any possible enemy's back door instead of off our own shores. We want to be able to provide warning of a possible strike early enough to allow ADC to concentrate defense forces and for SAC to launch retaliatory action shortly after enemy bombers leave their own shores."

The big birds more than proved their control capability during the USAF Rocketry Meet at Yuma this year. To demonstrate how accurately fighters can be vectored to a target from an airborne radar station, firing runs were made on the same type targets used during competition. At no time were the fighters more than a one-degree angle-off on a firing pass, although an angle-off of 10 degrees is allowable.

No difficulty was experienced in picking up either the target or the fighter aircraft on the scopes. Communications were above average and the fighters were vectored-in on a series of highly successful passes.

While it's true that the 552d Wing and its fellow unit, the 551st Wing on the East Coast, are still in the process of learning their tough grueling job, you can bet that if the whistle blows, they will be functioning efficiently as one of our first lines of defense. ●



SNAP THAT STRAP

THERE ARE A LOT of hardheads wearing hard hats in the Air Force today—most of them incorrectly. They hook and plug, but they don't strap. And that little strap is the difference. It's been a lifesaver on innumerable crash landings and ejections; yet daily this chin strap dangles loosely in its slot. Generally speaking, pilots abhor statistics. But take a reading on these. They're sort of interesting and have to do with the improper wearing of the P-1A or P-3 protective helmet.

- Head injuries were the primary cause of death in 12 per cent of all fatal aircraft accidents.
- Injury to the area of the head which is covered normally by the protective helmet accounted for 21 per cent of all primary major (non-fatal) injuries sustained.

Today's pilot is surrounded by checklists. The more he climbs into his aircraft, the more it becomes second nature to zip through these checks. However, what act do you think he does first when he gets into the cockpit?

A recent intensive survey revealed that a pilot fastens his seat belt and shoulder harness first. If this seat belt routine could include a second strapping—fastening the chin strap of his helmet—then the number of injuries caused by loss of the helmet would be lessened.

In most flying schools today, an embryonic jockey is fitted with a protective helmet. He has three straps to secure—his seat belt, shoulder harness and chin strap. He forms the habit early. The big job is to get ye olde types to initiate this SOP, pronto.

Gripes such as "Uncomfortable," "Itches," "I forget to snap it," "It chokes me," or "I've heard that it will break your neck in some cases," are all familiar tidbits in bull sessions. Every pilot has his own pet expression about this piece of leather. Yet the straps are adjustable and can be worn without unnecessary discomfort and there is no record of a pilot ever suffering a broken neck due to a helmet chin strap. The big trouble seems to be in getting it to fit the folds of the chin when a pilot grows older.

To bring everybody up to date, the type P-1 flying helmet became the P-1A after modification. Later, the visor mechanism assembly was introduced. Hence, the type P-1A helmet became the type P-3 helmet.

Now that we are squared away on the nomenclature let's get fundamental and pick up the loose ends; namely, that loose chin strap.

To don or remove the type P-3 flying helmet, make sure that the visor is in the up position, then place the thumbs around the lower portion of each earphone mounting pad and spread the sides outward a sufficient distance to clear the ears. The visor assembly can be raised by using the finger tips as a wedge and pulling forward. Moving the visor mechanism forward unlocks the assembly and allows the springs to raise it automatically. To lower the visor, pull down the yoke and allow it to lock in place.

After the helmet is properly positioned on the head, attach the chin strap to the snap fastener located on the helmet tab. Adjust the chin strap for proper fit by applying tension to the webbing strap threaded through the adjustable buckle located on the right helmet tab.

Here are some do's and don'ts that you should follow if you want to get the most from your headgear.

Some don'ts:

- Don't carry your helmet by the communications cord.
- Don't put your helmet down on the visor lens.
- Don't spread your helmet excessively when donning.
- Don't wear a sloppy fitting helmet.

The next time you stroll across the ramp, count the number of jet jockeys who are violating the number one *don't*, above. Or, take a look in the ready room and see how many visor lens are scratched from lying face down on a table or shelf.

Some do's:

- Fasten the chin strap.
- Carry your helmet like a basket or under your arm.
- Install the canvas cover over the lens of your visor when your helmet is not being used.
- Hang your helmet by the chin strap or set it upright.
- Thread the communications cord behind the shell lacing to prevent excessive flexing.
- Soiled parts of the helmet can be cleaned with a rag dampened with a cleaning fluid obtained from supply.

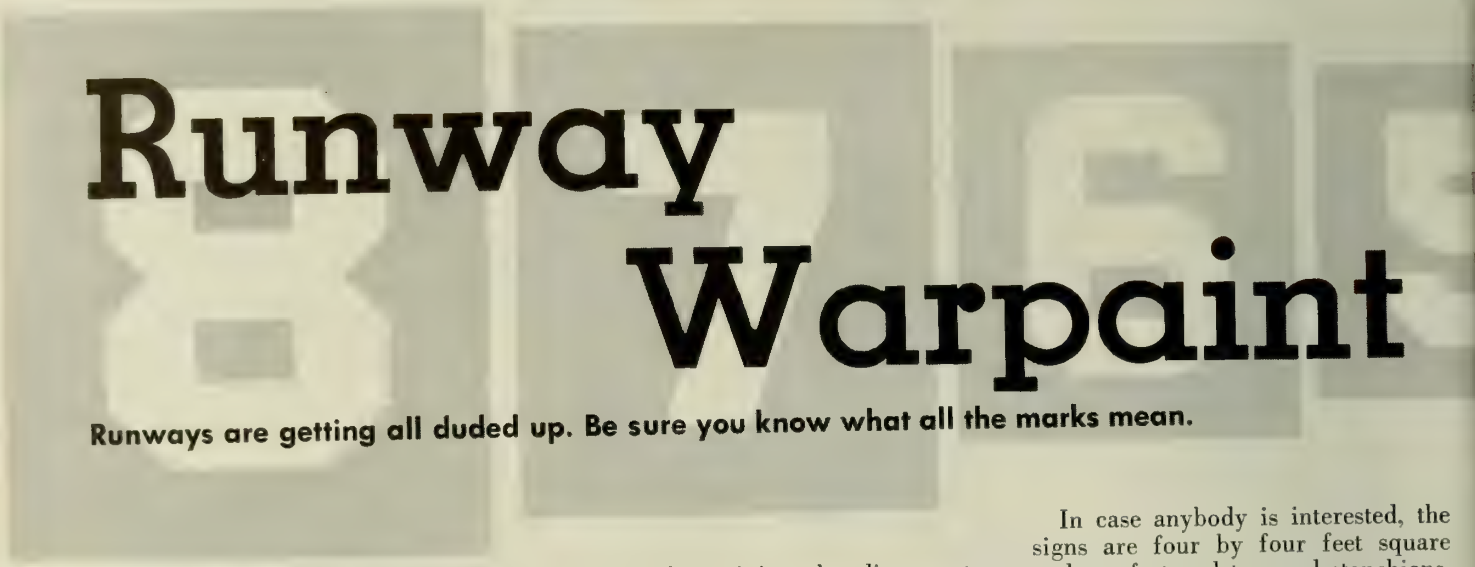
A comparison of accidents in which a helmet was worn (fighters and jet bombers) with accidents in which a helmet was not provided, revealed that about 15 per cent major and 7 per cent fatal head injuries occurred in the former, while 24 per cent major and 14 per cent fatal head injuries resulted in the latter.

Crewmembers in fighter and bomber type aircraft had the lowest percentage of serious head injuries, whereas crewmembers in trainer, miscellaneous and cargo aircraft had the highest percentage of such injuries.

Of 347 persons who used the ejection seat to escape from aircraft during 1949-53, 204 lost their helmets and oxygen masks. This is about 60 per cent.

Undoubtedly, airspeed at the time of ejection was a primary cause of loss of helmets. However, many ejection questionnaires and accident board proceedings show that crewmembers did not fasten the chin straps, thus contributing to the losses.

Make it part of your procedure to fasten the safety belt, shoulder harness and that chin strap. If you're forgetful, work out an agreement with your crew chief to give you a "chin strap fastened" signal. ●



Runway Warpaint

Runways are getting all duded up. Be sure you know what all the marks mean.

BEFORE BLASTING off, have any of you hot rocks noticed those signs that are set some 75 feet off to the side of the runway? The ones with the numbers on them? Or during the pitch-out, have you taken time to decipher those markings that are hieroglyphically displayed on the runway? Well, for the uninformed, those signs carry information as to the amount of runway remaining and can mean the difference between cavortin' or abortin'. Also, the runway is sporting that load of paint for a variety of good reasons.

Specifically, the runway distance markers are located on the left side of the runway at 1000-foot intervals. They were designed to check aircraft performance during takeoff rolls. They also prove useful during landing, in determining the distance to the spot where the concrete ceases and the boon-docks commence.

In accordance with AFR 60-16, all jet heads are required to compute the takeoff roll and enter same on the Form 175. The reason for this requirement is that there were too many aborted takeoffs resulting in (a) busted aircraft and (b) shook pilots.

The signs, consecutively numbered and uniformly spaced, implement this requirement. Now, with these easily read signs, there is no need to get panicky and abort or try to pull the beast into the air before she is ready to fly. Remember one thing, however. You compute the takeoff roll *required*, but the markers read the distance *remaining*. Thus, if the roll figures out at 4000 feet and the runway is 7000 feet long, wait until the 3000-foot marker comes around, not the 4000-foot one.

In case anybody is interested, the signs are four by four feet square and are fastened to wood stanchions. They are made of plywood, pressed wood or fabric and are painted with white reflective paint on a black background. In case you can't resist the urge to run into one of these signs, don't worry about it. They are constructed so that they will collapse without inflicting damage to the aircraft, it says here.

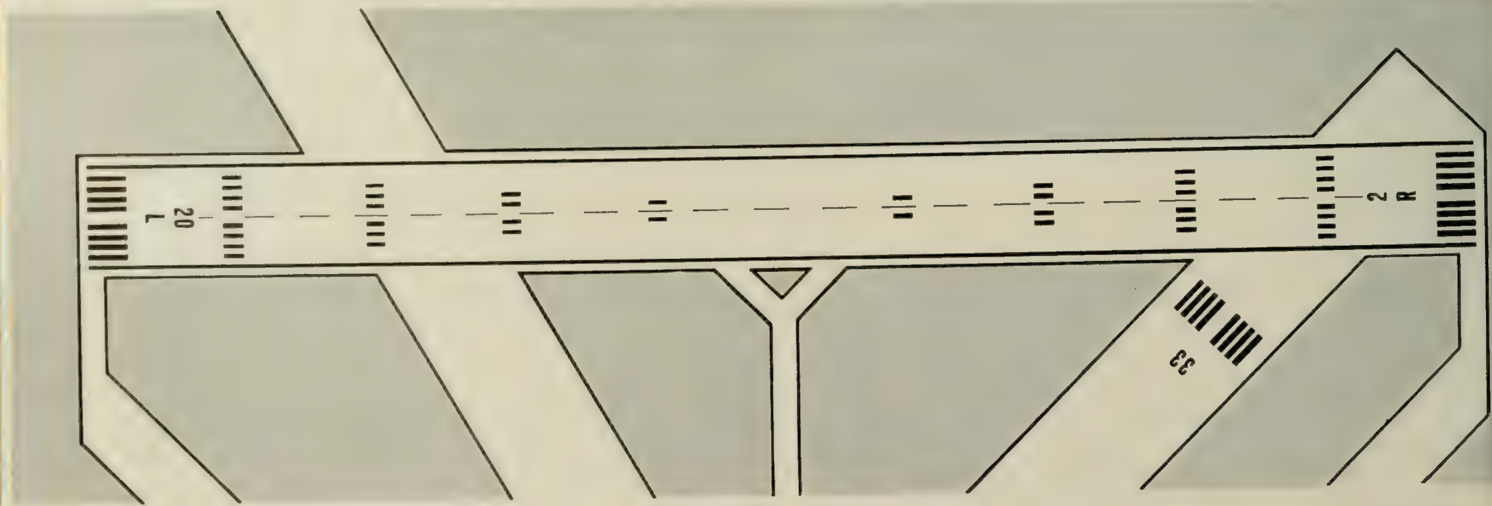
Runway Paint Job

Now, let's talk a little about that runway paint job. Just to prove how confused some fly types are regarding runway markings, listen to this semi-intelligent conversation.

1st pilot: "Say, Joe, what is the length of this runway?"

2nd pilot: "8000 feet, stupid. Didn't you see the eight stripes on the end of the runway when we landed? I sure did."

All-Weather Runway



A.O.: "Gentlemen, the runway is 10,000 feet long."

It turns out that since March 1954, the marking of runways with stripes to denote length has been discarded. Those eight stripes designate the threshold section of the strip. Regardless of the runway length, those 12-foot wide, 150-foot long, white stripes will appear at each end of the runway and will always be eight in number. For those of you who are intellectually minded, they carry the nomenclature of threshold markings.

Cheery daubs of yellow paint known as touchdown markings are used in conjunction with the aforementioned distance signs. For runways of 8500 feet or less these consist of three-foot wide stripes placed across the runway some 2000 feet from either end. For runways longer than 8500 feet these markings will be 3000 feet from the end. The idea is that these little daubs rough out the first third of the runway. In addition, there is a runway mid-point marker to aid in telling you how far you are down the runway. It is a cross-patch affair consisting of two bands, two feet wide, extending across the runway.

Three Types of Runways

The Air Force classifies runways into three types: Basic, instrument and all-weather. Basic runways are those runways that you see on small auxiliary fields or on small civilian airports. They are practically nonexistent in the Air Force.

The other two runways are illustrated at the bottom of the page. Instrument runways are the most common to all Air Force bases, worldwide. All-weather runways are the large-size editions that are scattered across the length and breadth of the land and can be differentiated by the smaller painted stripes within the first 2000 feet of the runway.

The large letters designating runways, in case there are parallels, are common knowledge. For instance, *L* for left runway, *C* for center runway and *R* for right runway.

There is no longer a visible means from the air of determining runway length. You'll have to consult the Radio Facility Chart or call the tower for this information.

Incidentally, the Civil Aeronautics Administration goes along with these markings 100 per cent, if you are landing at a civil airport. However, it should be remembered that some Air Force bases may not have their runways marked yet.

Blast Pad Damage

During the runup for takeoff, there is a little patch of paving surface just back of the threshold on most runways that is being abused. This blast pad, as it is officially labeled, is getting some mighty rough treatment by some heads who like to brag about touching down on the end of the runway and who are actually hitting the blast pad area.

This pad is a two-inch thick section made of highway paving material, 250 feet in length and is the exact width of the runway. It is marked with yellow chevrons and is strictly a non-traffic area. When you land on this pad you stand a good chance of breaking up the threshold lights and damaging your tires, not to mention busting up the concrete.

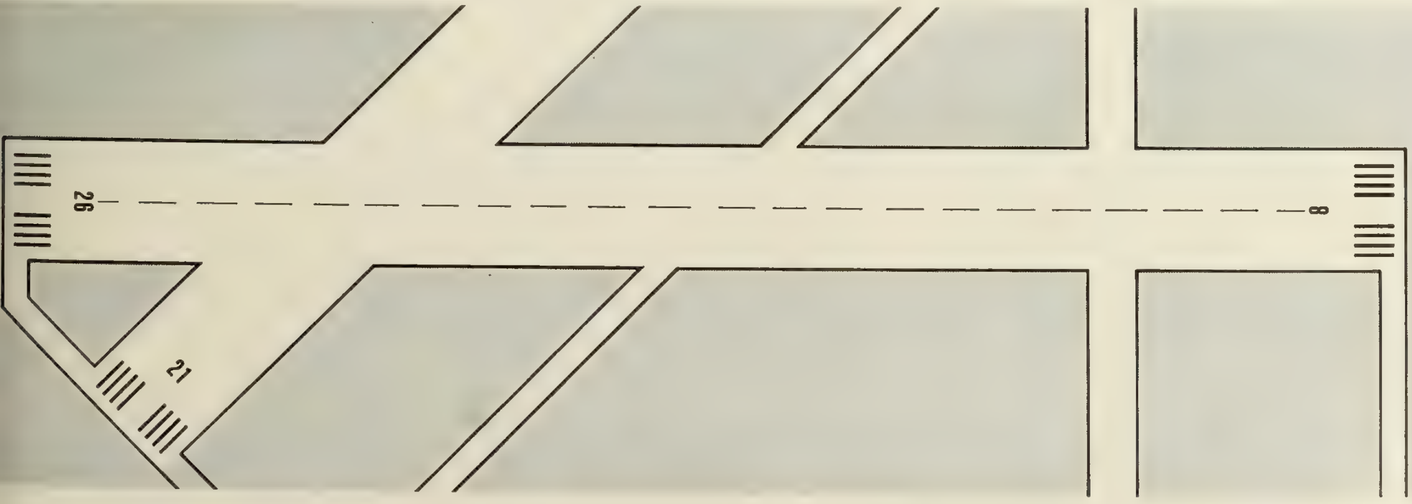
Runway distance markers are designed to check aircraft performance during takeoff.

In some parts of the world small spruce trees or light wooden tripods are placed along the sides of the runway for wintertime markings. Be prepared for your venture into this type of landing by getting thoroughly briefed before you leap off.

When the snow falls watch for any unique, but useful, runway markings.

A good thing to remember is that these little stepping stones to the ozone can help you a lot . . . if you know how to use them. ●

Instrument Runway



From Spangdahlem To Kisarazu

A REAL BLOW for flying safety was dealt last month and the repercussions will echo around the world. Not only will these repercussions travel far and wide, but they should make a sizable dent in the future aircraft accident rate; and that certainly is close to the hearts of all of us who operate aircraft.

Now, no one wants to become a statistic. Nor does anybody want to get hit in the pocketbook, and you can stay in the black on both counts if you can keep from becoming involved in an aircraft mishap.

What's being done to help you? Many, many things. And they all involve the man commonly referred to as the flying safety officer. Perhaps, on your base he is known as the director of safety, or the assistant to the vice commander for safety; but regardless of his title, he is interested in aircraft accident prevention and in balancing the accident budget.

In this case, we are referring to the recent World-Wide Flying Safety Officers' Conference held at Randolph Air Force Base, Texas. As Brig. General Joseph D. Caldara, Director of Flight Safety Research, stated during the meeting, "When you get 130 flying safety officers together to discuss aircraft accident problems, you are bound to come up with some constructive solutions." And he was right. Flying safety officers from all parts of the globe met to discuss some of the known aircraft accident problems and, to put it mildly, they came up with some solid solutions.

The discussions were centered around problems in the fields of training, facilities, maintenance and operations. They were based on known accident histories and were of concern to all Air Force bases, in varying degrees.

FSOs from near and far welcomed by General Caldara as safety conference got underway.

Specialists from the Directorate of Flight Safety Research talked briefly on these specific problems. However, after these presentations, the ball was carried almost exclusively by the conferees. They were the ones who came up with the recommendations and proposed solutions.

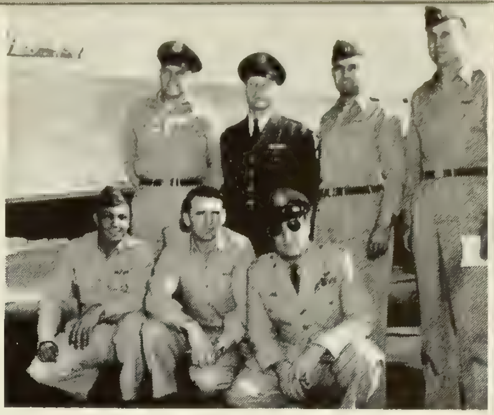
Let's take an example of a normal conference day. This way, you can see how the results of this conference can hardly miss reaping rich rewards in the prevention of costly and unnecessary aircraft accidents.

Each morning, the representatives of D/FSR discussed the problems in two of the categories and showed from actual reports how they caused or contributed to aircraft mishaps. Figures and data compiled by Flight Safety Research were presented to vividly emphasize the fact that accidents caused by these problems can and must be eliminated.

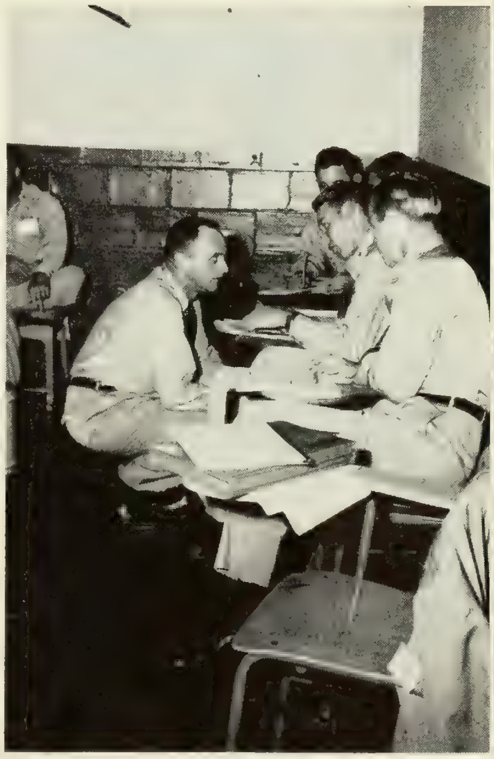
Here, for example, are the three problems that were presented in the operations category:

- How can we, as supervisory personnel, assure ourselves that pilots know the aircraft they are assigned to fly?
- How can we lower the frequency of undershoot landings?
- How can we lessen the hazards created by present-day limitations in weather reporting and forecasting equipment and procedures?

Following the morning presentations, the FSOs split up into 10-man seminar teams with a leader and a



Left, small, informal seminars were formed to discuss selected problems. Above, FSOs from as far off as FEAF also were present. Below, even informal chatter contributed to the exchange of accident prevention ideas.



D/FSR advisor to insure discussion progress.

Here are just a few concrete examples of recommendations on the operations problem — knowing your aircraft:

- The conferees felt that pilots selected for combat crew training should receive transition in aircraft possessed by their parent organizations. If unassigned, they should be placed on duty with an organization that has identical aircraft.
- Any pilot checking out in a new aircraft should receive adequate formal classroom lecture training, to include mobile training unit instruction, if available, followed by a closed-book examination and spot questions on the aircraft.
- Emphasize annual proficiency checks to include blindfold checks on emergency procedures and a thorough examination of a pilot's ability to cope with emergency situations.
- Strong emphasis was placed on a requirement for simulators, plus TF or TB models, prior to receiving tactical aircraft.
- Limit the number of aircraft in which a pilot can be proficient and place more emphasis on simplification and standardization of cockpits and systems.
- Man mobile control units with a qualified pilot to monitor and record all approaches, patterns and landings.
- The idea was advanced to establish a base transition and instrument training program under the best qualified instructors with the requirement for completion of the check twice each year. All pilots should attend the school and pass the check, with no exceptions.

After the seminars were completed, each leader took the rostrum and presented the solutions or recommendations arrived at by his group.

Following these presentations, each solution or recommendation was discussed in an open forum. It is not difficult to imagine the many ideas, and possible solutions to these problems, that were exchanged.

A typical exchange of ideas occurred when an FSO from one base raised a question in the facilities category concerning, "What to do with that dangerous lip at the end of the runway?"

His question was answered by a cohort who arose and stated, "By close daily inspections, I find you can keep on top of the runway overrun or lip problem. I discovered a three-inch lip on the runway at my base one day, last month. I could have made a report, submitted a work order and so on, then waited with my fingers crossed until necessary repairs took place. However, I discussed the problem with the air installations officer and he put a couple of loads of dirt out there, compacted them and that removed the hazard; at least until permanent repairs could be made."

That is really an example of doing something *now* to cut down on the accident potential around the airfield. And the philosophy of *doing-it-now* is a major factor in this accident prevention business.

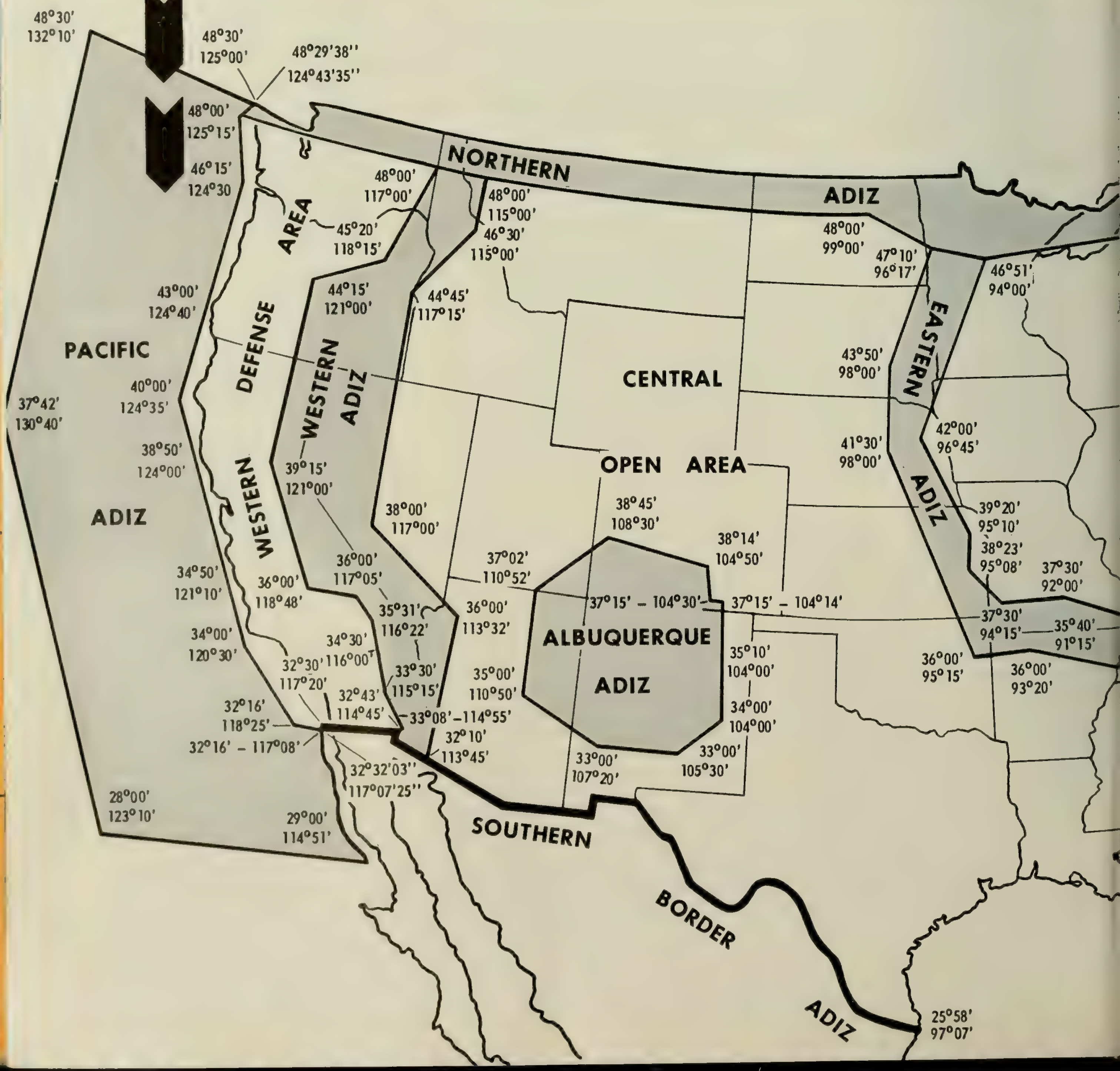
The many solutions and recommendations arrived at during the conference are far too numerous to mention here; however, you can bet your next month's flying pay that your FSO has them all on paper.

As a direct result of this conference, many an FSO who felt that he had hit a stone wall in a particular problem at his base suddenly found out that other bases had a similar problem. Furthermore, he discovered how other bases tackled it; some successfully, some unsuccessfully. Perhaps he learned that there is a proved solution; proved, in that it did the job for another FSO. As a result, he will return home with both proved and possible solutions to problems that in the past had been deterrents to his accident prevention program.

The response to the conference was overwhelming. Everybody worked hard and was richly rewarded in receiving additional information and ideas that will help to do the job of "*conserving our national resources through the prevention of costly and unnecessary aircraft accidents.*" That's like money in the bank. ●

New Defense Areas and ADIZs

When it comes to identification zones, it pays to know the whys and wherefores . . . and this map and information should help you learn.



As you can see from the accompanying map, there have been some drastic changes in the overall Air Defense Identification Zones structure.

The new ADIZs and the newly designated Defense Areas and Open Areas become effective 1 December, and while the changes have appeared in the Radio Facility Charts, Flying Safety believes that a complete rundown on all the new areas and the procedures to be used in them will be valuable to Air Force crewmembers.

One change that is more important to civilian pilots than to the military is that aircraft flying at a TAS of 110 knots or less, at an altitude of 1500 feet or less, are exempt from AFR 60-22 except in times of emergency as outlined in paragraph 12.

Some of the changes in areas and procedures are quite different from what you are used to, so read them carefully and know what you read, if you wish to avoid any possibility of that old bugaboo, a violation.

First of all, you will file either a DVFR or an IFR flight plan, prior to takeoff, in writing or by telephone, with an appropriate aeronautical facility when your proposed flight:

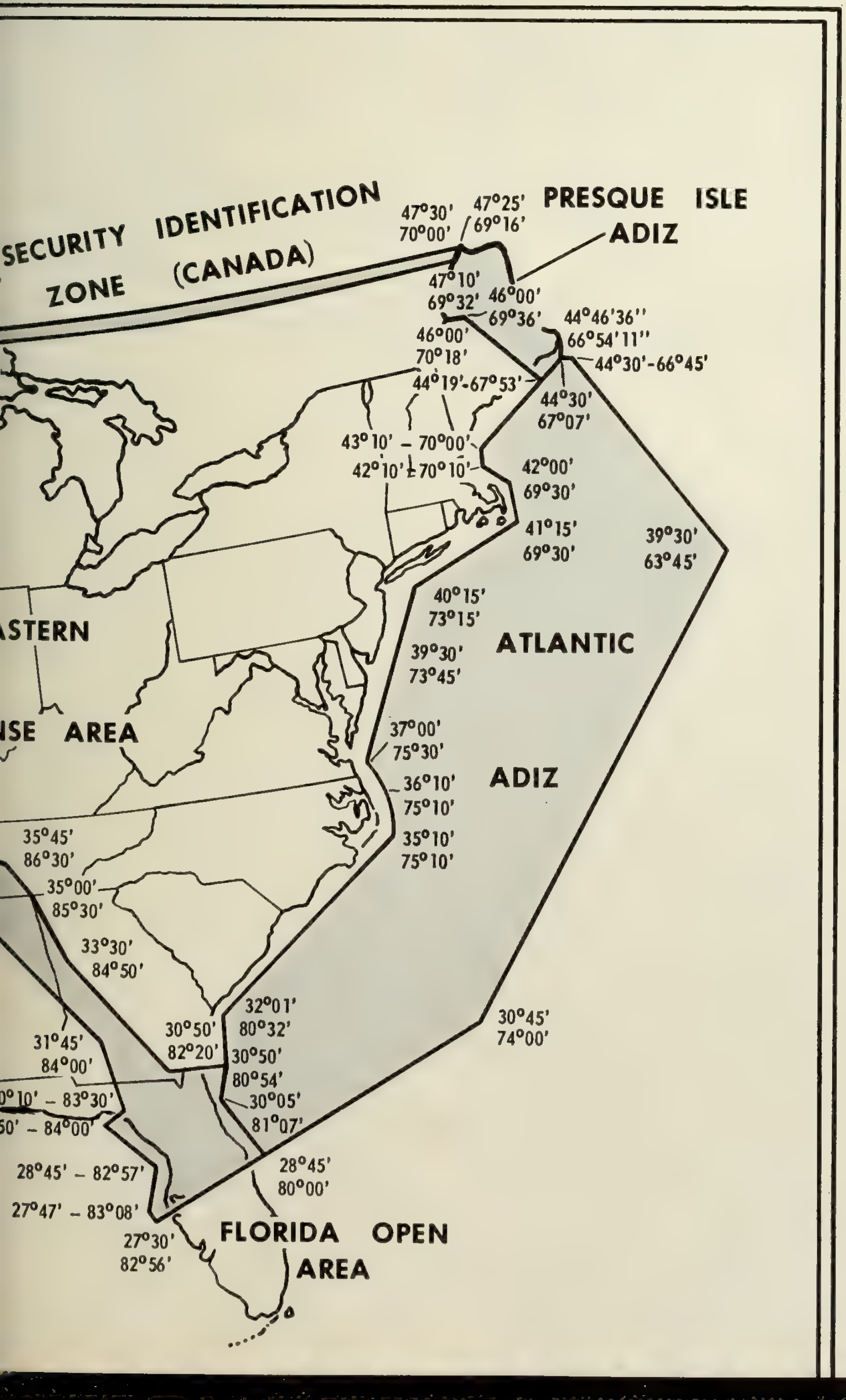
- Originates outside of the United States and penetrates a domestic ADIZ toward the United States. The domestic ADIZs include the Northern and Southern Border ADIZs and the Presque Isle ADIZ.
- Penetrates or operates within a Coastal ADIZ. The Pacific and Atlantic ADIZs make up the areas defined as Coastal ADIZs. In this case, DVFR is required on penetrations both inbound and outbound.
- Penetrates the Eastern or Western ADIZs toward a Defense Area, or when operating within either ADIZ.

Now here is one of the big differences in procedure. You can start a flight from a Defense Area and land in the adjacent ADIZ without filing DVFR, or you can take off from either a Defense Area or the Eastern or Western ADIZ and fly toward and land in the Central or Florida Open Area without filing DVFR, providing you do not penetrate the Albuquerque ADIZ or the Northern ADIZ. For example, you could take off from Norton AFB and land at either Nellis AFB or Hill AFB without filing DVFR. However, in filing from either Nellis or Hill to Norton, you would have to file DVFR as you would be penetrating a Defense Area.

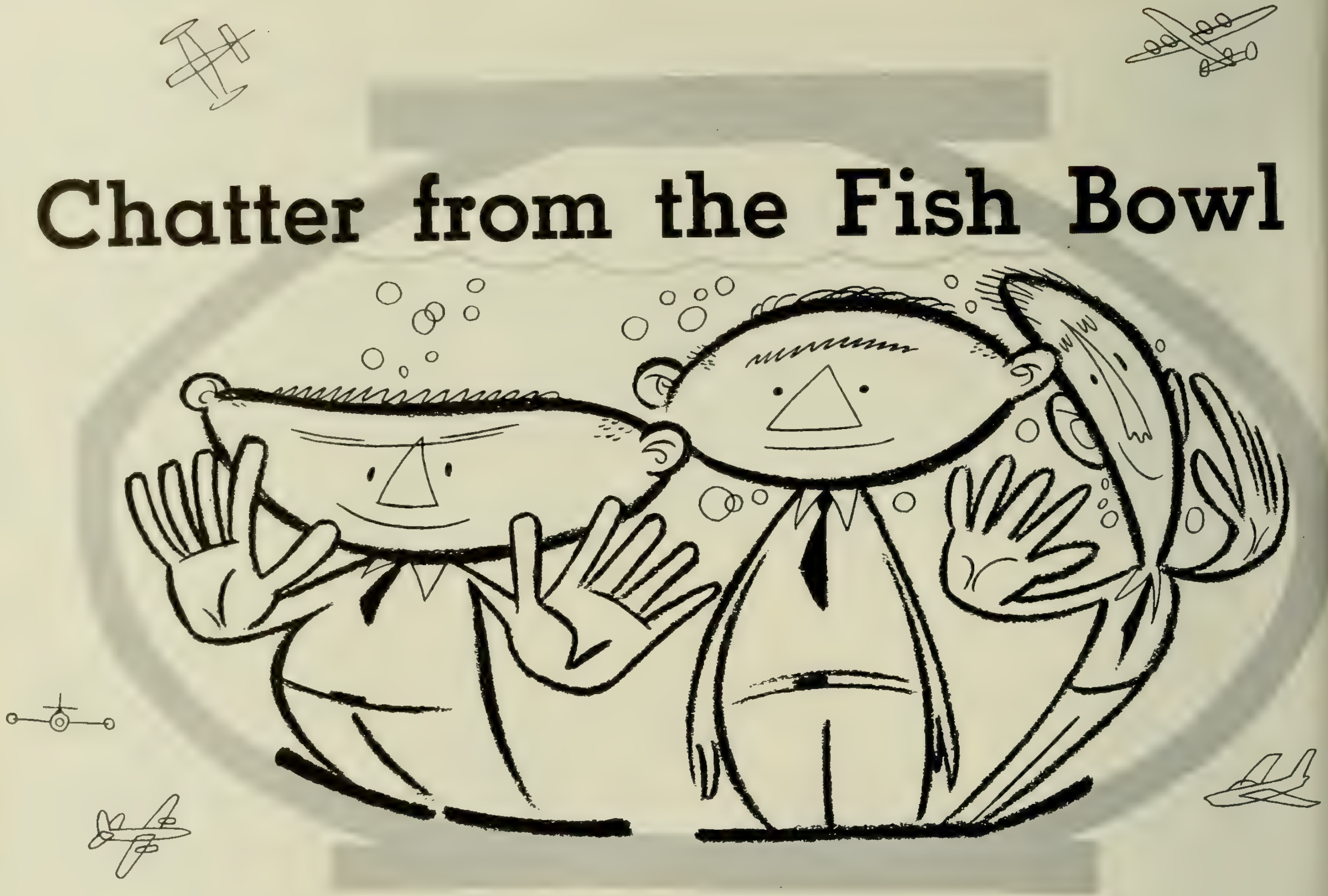
- Penetrates or operates within the Albuquerque ADIZ. Once again, there are some different procedures involved in operating in this ADIZ. Any flight originating within the Albuquerque ADIZ, which maintains a track away from the Los Alamos prohibited area need not file DVFR while within this area. This includes westbound and southbound flights, and eastbound flights on civil airways.
- Another change in DVFR flight rules states that deviation from the flight plan is authorized if prior notification has been given an appropriate aeronautical facility. Thus, a flight plan may be changed to include a penetration if you notify the proper radio facility and receive approval.

The procedures involving the Security Identification Zone, which lies between the Northern and Presque Isle ADIZs, are under the jurisdiction of the Canadian government.

One more important point to know is that flight inside a Defense Area exclusively can be made VFR. For example, you can file VFR from McChord AFB to Hamilton AFB, as you would be operating within the Defense Area. ●



Chatter from the Fish Bowl



I HAD TO pause at the entrance of the "greenhouse." Laboring up five winding flights of stairs can be quite a task. I took a gander at the parked aircraft on the ramp, at the jet taxiing out for takeoff and at the C-124 which vibrated the tower as it climbed out of the pattern. It seemed to me that the sounds of everyday air base life were a bit muted at this vantage point above the hangar.

Primarily, I had made the long climb up to the control tower because I was curious. Sure, I've been in control towers before, fairly often too, but strictly in a passive sense. Then, also, I've noticed that tower operators are among the most maligned of all the troops involved in the flying business. It's easy to give them a verbal or mental pasting every time you have to wait to take off or land or for taxi instructions. So I decided to find out just what these lads have to do and what skills they need to interpret the various regulations and to operate the control panels, gages, switches, mikes, recorders, light guns and scopes which fill their fish bowl to bursting. So here I was at the tower door.

As I opened the door to the temperature-controlled room, a veritable maelstrom of noise hit me. My first thought was, "How can anyone make sense out of all this unintelligible chatter?

After introducing myself to the two airmen who were working this trick, I followed a procedure that I would recommend to any other tower guests. Back off to a neutral corner, open your eyes and ears and digest what is going on around you before venturing into the why's and wherefore's.

My eyes stopped first on the room-wide console in the front of the tower. UHF, VHF, HF and LF loudspeakers were banked along the topside. Flip switches for each frequency were positioned beneath their respective speakers, with a slatted, latticed filing panel next to the loudspeakers.

My wind having returned, and noticing that a rare moment of silence had stilled the room, I directed my question and answer barrage at the trick chief who had accompanied me to the tower. "Just so I'll have an idea of what all this equipment is used for, how about giving me a rundown?"

Equipment Rundown

The sergeant took a deep breath and plunged in, pointing out each item, "The console has a field lighting panel, meteorological equipment, flight progress board, crash phone panel, transmission recorder equipment and an aircraft movement and flight data recording board. There are 62 transmitting and receiving switches in the tower, and tower men must be able to operate all of them in total darkness.

"Here is the 18-channel UHF set, the VHF equipment and a compass locator monitor. We have also a low frequency transmitter and receiver to control the crash trucks and some of the field utility vehicles."

Next, he indicated the multi-channel intercom boxes which connect the tower to base ops, transient alert, weather, crash stations, the flying safety office, engineering and AACS. Also, there is a direct telephone line to approach control facilities, ARTC and Flight Service. He moved from there to the telautograph, which in layman's language is the gadget that transmits weather observations from the weather station; then to the battery of telephones and last to the UHF/DF equipment. This last gimmick intrigued me no end and I decided to ask some questions about it a little later.

When I asked the sergeant how high a wind velocity was necessary to make the tower rock, I got a grin in return. "About 100 mph, although towers are stressed for 105 mph. It would take a real blow to knock this baby over."

There were two men on duty in the tower. A staff sergeant, handling the mike at position *A* and an A/2C at position *B*, who was copying an IFR clearance at the moment.

Tower Duties

Although the equipment is not labeled *A* or *B* station, an explanation here might clear up some pertinent points. Tower duties fall into two broad categories. The controller operating the traffic microphone and all of its multitudinous facets is the *A* station man. While he is busy keeping pilots happy, in a very loose sense of the word, the operator manning station *B* copies clearances and handles secondary communications. But I'll get into more detail on each man's specific duties later on.

I noticed the three light-guns hanging from the ceiling within easy reach of the controller and asked the staff sergeant if they are used as much now as they were in the early 1940's.

"No, sir. Most of our air traffic is handled by the high frequency channels that you see here. Mostly we use them to give clearance to vehicular traffic across the runways. Only in case of radio failure are they used for landing."

I noticed that as he ended his conversation with me, he cocked an ear toward one UHF frequency loudspeaker. I tried to make sense out of the air clutter which had commenced again, but found it difficult to understand. A tower operator from a base 20 miles away kept cutting in on the frequency and garbling the pilot's request. But somehow the operator understood the message and gave out taxi instructions, as requested.

During a momentary break in the chatter, I asked how he could ferret out what transmissions were directed at him and how he could tell from which loudspeaker the sound was coming?

"Experience, sir. It just takes a lot of listening. For instance, take a jet pilot at altitude requesting landing instructions. You can hear him breathing and there is a high, nasal pitch to the voice. On the ground the sound is entirely different. I guess after you have heard so many of them, you just listen for the tower prefix and automatically each voice registers different. It just takes time."

During the next few minutes I learned that some tower operators can remember the identification numbers of from seven to nine aircraft at a time and from the pilots' position reports, can place them in the pattern in their proper order.

Practice DF Steer

Just as I was about to launch into another series of questions, a request for a practice UHF/DF steer came in. I moved up to the console and watched the operation.

Asking for the pilot to give him a five-second transmission, the tower operator flipped up a switch and the DF set went to work. The needle swung to a heading of 30 degrees and froze there.

"This is a vital piece of equipment. Pilots seldom get lost. By their own admission, however, they can become disoriented or misplaced. When this inability to precisely locate themselves crops up, they usually give us a call." I might add that this statement was uttered with a wide grin on a young face. After a series of steers the pilot called in and stated that he was over the field.

Incidentally, the type of DF facility in a tower, if it has such equipment,

Pay your control tower a visit. It will help you understand some of the operator's problems.

can be found in the Radio Facility Chart. The tower operator gives you a no-wind heading to the transmitter of the set, which is located along the perimeter of the field.

Next, I noticed a slim needle making scribblings on a continuous roll of paper, which was mounted above the DF set. Thinking it was some part of the equipment, I asked about it.

"No, sir, that is a graph roll connected with the base weather station. It keeps us informed as to the current weather, and is especially useful during periods of marginal ceilings and visibilities. Instead of having to call them, when they might be very busy, one of the station men can relay us the weather by this means. This way we know the latest reported conditions almost to the minute."

As he was talking, my eyes were roving about and settled upon another type of roller disc. I asked about it and without hesitating he indicated for me to watch. He depressed the mike switch and immediately the roller disc started rotating and a metallic finger drew a line across its surface. Yep, it was a recorder. A record of every transmission made is permanently inscribed on this disc. Its uses are obvious in cases of accidents, investigations or research studies on extraneous transmissions.

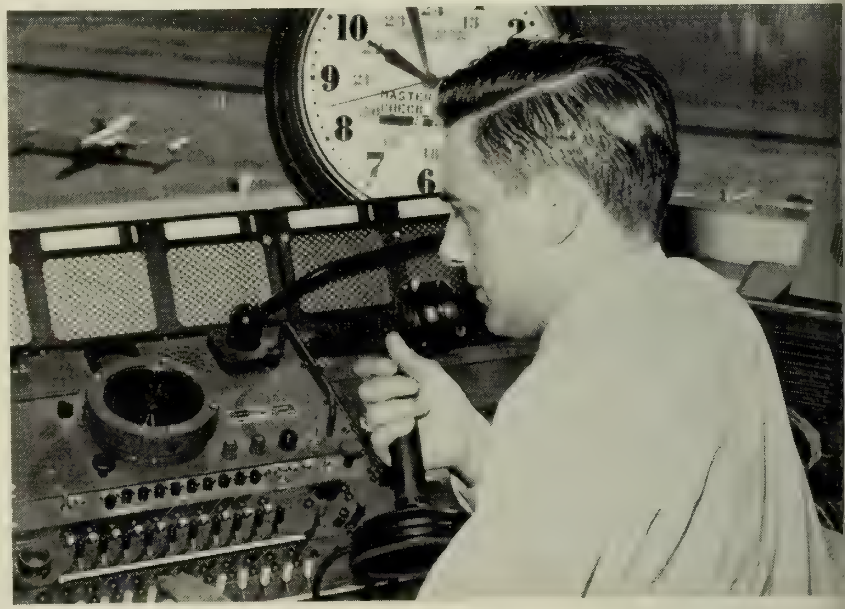
Emergency Procedure File

I had been told that there was a set of Tech Orders on all aircraft in the tower. Just as I was about to broach the subject, the tower operator turned to me from his stand and pointed to the typewriter table. There, in an orderly file binder, were some red-bordered sheets.

"We are required by AFR 5-52 to have a current file of emergency procedures on all aircraft in the USAF inventory. For example, if a pilot declares that he can't get his gear down and has tried all of the emergency procedures he knows, he calls us. We have all the T.Os. here and we get on the horn and call base operations. In the majority of cases something is figured out which will get the aircraft on the ground safely."

I walked over to the typewriter desk as he turned back to his loudspeakers and glanced at a printed form that was in the machine. It was a required report that has to be made by the tower operator as to the status of his equipment at the start of his duty. It reminded me of a preflight inspection that a pilot has to make before starting up.

Between copying clearances, giving landing instructions and working aircraft on the DF equipment, tower operators are often very busy; so keep chatter to a minimum.



About this time the air traffic control officer of the AACS Detachment puffed into the cab and, after letting him get his breath, I hit him with a few questions on the background training needed to become a tower operator.

My first question was, "What type of schooling does a controller have to pass successfully to qualify him to handle all of the traffic that comes into this base?"

Area Check for Operators

"Well, sir, before I answer this one specifically, I'd like to bring up a point. Before any tower operator is permitted to take over the *A* station position, he must pass what we call an area check, both written and oral.

"To get an idea of what this means, here is the Radio Facility Chart page for this area. Draw a circle with a 50-mile radius around this base. A tower operator must know all radio stations, their frequencies, bearings from the station to the field and their power output. He must be familiar with all landing fields in this area; runway directions, lengths and strengths.

"He must know the data on all radio facilities, such as tower frequencies, UHF/DF, VHF/DF, radio beacons and homers. He not only has to know their frequencies but also their physical locations. He must be aware of all obstructions and hazards in the area. He must have at his fingertips a knowledge of all Air Route Traffic Control procedures and Flight

Service Center policies, plus all pertinent local flying regulations and any peculiar traffic pattern problems.

"A tower operator must know, and I mean know, all of this almost instantaneously or at least know where to find it. He is given regular six-month checks to keep him alert to any changes."

As an afterthought, the captain added, "Most operators can fly any type approach on a Link, so they know most of a pilot's problems on low approaches."

He continued, "To get back to your question on tower operator training. All schooling is held at Keesler Air Force Base, Mississippi. Subjects include weather, radio aids to navigation, air traffic rules, airways traffic control and simulated operations. Airmen are eligible also to attend on-the-job training with CAA for a period of six months, if they have attained a 5 level AFSC and have enough retainability in the Air Force."

A and B Station Duties

I countered with another question. "After school then, as I understand it, the apprentice reports for duty and you head him toward the *B* station. Can you give me some details on what he does?"

We walked over to a functional chart which was leaning against a wall. "If you don't mind a bit of AACS terminology, here's what a *B* position operator has to do. We call it the idiot perch. He holds down the flight data position. He receives and transmits aircraft position reports, flight plans and departure and arrival reports concerning aircraft within the control area over the interphone and telephone. He transmits flight plans, flight progress reports and arrival and departure reports of aircraft to operations and other interested agencies. He must have about 10 hands; see all, know all and help his poor bewildered trick chief over the hurdles. This operator determines the efficiency of tower operations. Briefly, he handles most of the telephone work with base ops, Flight Service and with ARTC.

"As for the *A* station man, he is the local controller. He transmits traffic clearance information, weather reports and forecasts to pilots and landing and takeoff instructions. He supervises subordinate air traffic control technicians and conducts on-the-job training on his shift."

I had another question for the air traffic control officer. "How much leeway does a tower operator have in handling the peculiar traffic problems of his base?"

Controlling the Airspace

It seems as though the base commander rules the airspace above his base. Through his base operations officer he lays down the law. AACS feels that if they satisfy the base ops officer, they are satisfying the pilots flying from his field. AACS must abide by the provisions of the Air Force-Navy-Civil (ANC) approved procedures for control of air traffic, plus Air Force regulation 60-16, CAA regulation 60 and AACS regulations covering radar.

Pilots may not like crosswind landings and sometimes complain bitterly to AACS, but the base operations officer, in the interest of flight safety, is the one who can change the operating conditions. Of course, a pilot can refuse to land on the designated runway if he so desires, but the tower operator is merely following the instructions of the base ops officer in designating the landing runway.

Fast Closure Rates

The days are gone when a pilot could depend on the old rule of "see and be seen." The closure rates of modern jet aircraft have far outstripped the capabilities of human vision and reaction time. Further expansion of the Air Force and the introduction of more high performance aircraft can be expected to increase the possibility of mid-air collisions.

A current file of emergency procedures on Air Force aircraft is maintained in tower.

Along with mid-air collisions, there are other tower problems. Congested frequencies have created a lot of headaches. UHF now is more congested than VHF, and tied in with this channel congestion is the problem of extraneous transmissions.

Keep Mike Chatter Down

Special requests, like having the tower call Old Mack at 1987 to tell him that you'll be in at 1030 and for Airman Glotz to have the car at base ops are examples. If the tower is busy, it won't be done and if the tower is not busy at the time, it may or may not be done. So, as they say in the old school, "Knock it off."

So the age-old advice about proper use of the microphone is again repeated. Have a listen before you start yakking. The air chatter in a tower sounds like a Donald Duck record being played at double speed. Also, the policy that some pilots follow about letting the tower know how many passengers they have aboard, how much freight and so forth doesn't have a thing to do with the control

Information necessary for local traffic control is transmitted by A position operator.

of traffic. (Editor's note—see article on page 28.)

Another big problem that tower operators face these days is that traffic is a lot faster than it used to be and there is more of it. They state that it's a breeze to handle all-jet traffic at a base, but mix a couple of transports or trainers into the middle of a zipping bunch of jets and the gray hairs start popping out.

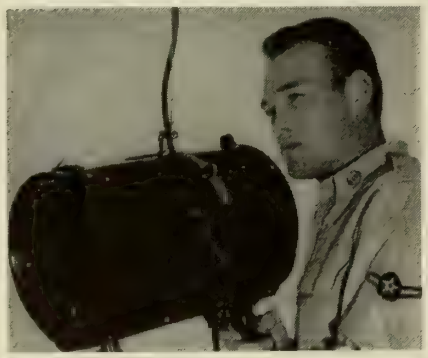
As I took one last glimpse down at the ramp and watched a B-47 crew board their bird, I threw the sergeant one last question. "What are your biggest gripes about pilots in general? After all, they heap a lot of abuse on you."

Tower Problems

This question definitely shook him up. His face lit up and mentally he rubbed his hands together. This was a chance of a lifetime. A chance for the boys in the tower to express their views, as usually the pilots have their say and that's that.

"Well, to begin with, Uncle Sam's pilots are just about the sharpest bunch of flyboys in existence. We know it. I just wish they didn't think the poor dopes in the tower are there to match wits with them. Often I visualize the fiendish glee in a pilot's eye as he cuts somebody else out of the pattern and makes it on time to the club. I would like to see his face if he realized just how close he came to getting his wings clipped permanently by the T-Bird that had one pilot under the hood and the other cleaning his fingernails. Sometimes it's really hard to keep the language clean on the mike, and besides it doesn't help our ulcers.

"If a pilot chooses to disregard the tower instructions, that's his red wagon. No doubt he has good reasons—his mike was stuck—the tower was blocked out—or something. The only catch to this is that the pilot he almost clobbered, who was following instructions, has some very nasty comments for us people in the bird cage, and who can blame him? Sometimes that traffic pattern gets to be like a Memorial Day race, with the tower just sort of an unofficial referee. It all boils down to a case of everyone abiding by the rules."

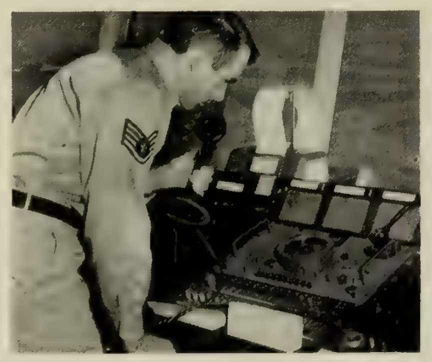


Light guns are used now only to clear planes when radio failure occurs and to control the movement of vehicular traffic on the airport.

Cooperation Helps

He continued, seriously, "Most pilots are cooperative, courteous and really try to help as much as possible. It's just that one per cent that makes life hard sometimes. For instance, the pilots and airport personnel who disregard instructions. Or the fact that too many pilots know too little about ATC problems. Then, there are the impatient pilots. Particularly those who have been waiting quite a while for an ATC clearance. They seem to feel we are trying deliberately to stall them. This not only upsets everybody, but blocks out other transmissions, slowing things up still more. Then there is the occasional lack of coordination from other units. We don't have time to argue. Things generally are happening thick and fast. Sometimes people seem more interested in putting across their point or gripe than in cooperating and getting the job done.

". . . a pilot seldom gets lost, but sometimes a DF steer comes in handy if he's misplaced."



"And remember, it takes two years from the time he enlists to get an operator to where he can handle VFR traffic safely and to where he really will be worth something to the Air Force. It takes from five to seven years for a controller to become familiar with all types of weather and all types of operations. It requires a great deal of study and experience and, above all, it requires accepting a lot of responsibility.

"Pilots can make it tough for us by not spacing themselves properly in a VFR traffic pattern, yet they expect the tower to provide proper separation. Some do not remain on tower frequency while taxiing and can't receive additional instructions, if necessary. Other pilots do not maintain radio discipline. They call each other all of the time and yak endlessly.

Know Your Procedures

"Many pilots are not familiar with reporting procedures required during letdowns, instrument approaches and for on-the-top clearances as established in ANC manuals.

"Well, sir, that about does it. Like any other facility with as many phases and problems as the tower, there are a good many gripes and there always will be."

I picked up my hat. "Thanks, sergeant. I'll see what we can whip up. I think you mentioned also that if instrument schools in the Air Force, from base level up, would put in some curriculum hours on the ANC manual, it would help a pilot to more thoroughly understand the tower operator's viewpoint. Isn't that right?"

"That's right, sir," he said. "Glad to have had the chance to show you the tower. We get sort of lonely up here. We'd welcome visits from a lot more pilots. And I think they would find it interesting, too."

I closed the door. The chirp of a flock of birds on the hangar roof sounded like the arrival of spring, which was still six months away. I picked my way down the steep stairway. It was easier going down than climbing up. But it had been worth it. I figure I'll lay off that mike button a little more now than before. ●

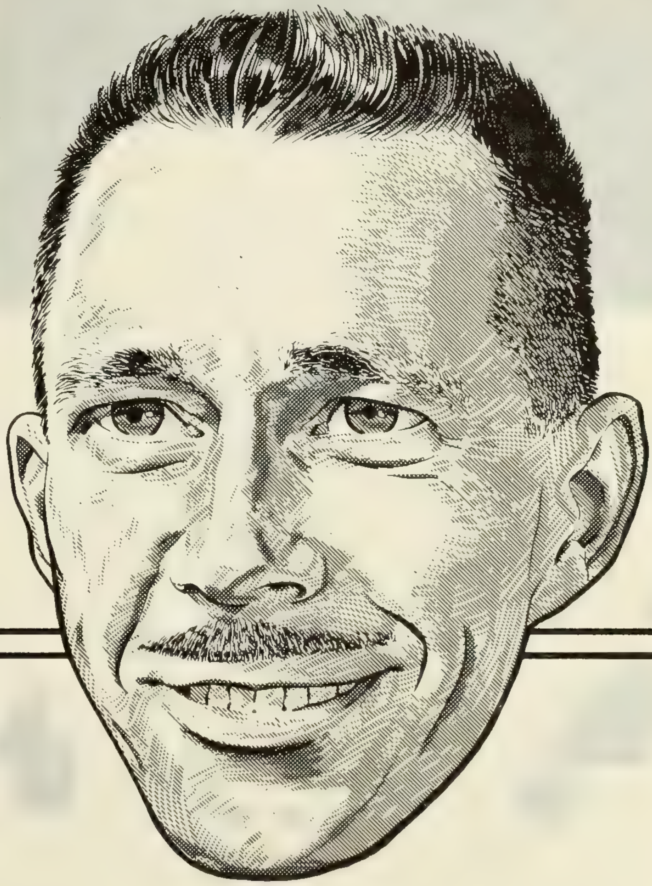
WELL ★ DONE ★

CAPT. MYERS was in base ops at Adana, Turkey, when a teletype message was received requesting that a communications check be made on a long overdue C-47. Upon learning that radio facilities were inoperative after regular duty hours at that station, he went out to his C-119 and contacted the C-47 on VHF. Visibility at the time was less than 100 feet due to heavy fog and Capt. Myers notified the pilot that it would be impossible to land. He requested a fuel check, and was informed that there were only 65 gallons of fuel remaining and that the pilot did not believe he could make another field as the entire Turkish coast was socked in.

Myers then advised that an attempt be made to reach another field approximately 125 miles away that would be open, and gave the proper heading to the base. He requested frequent progress reports so that a position could be established in the event ditching in the water became necessary.

At this time, the plane was reaching VHF limits and Myers had his radio man make contact on liaison. The pilot stated that they were still about 55 miles from the destination and had 30 gallons of fuel left. Immediately after this contact he declared an emergency. After calling MAYDAY, the C-47 pilot was able to contact his destination on VHF and was directed to a nearby field where he landed with only 10 gallons of fuel.

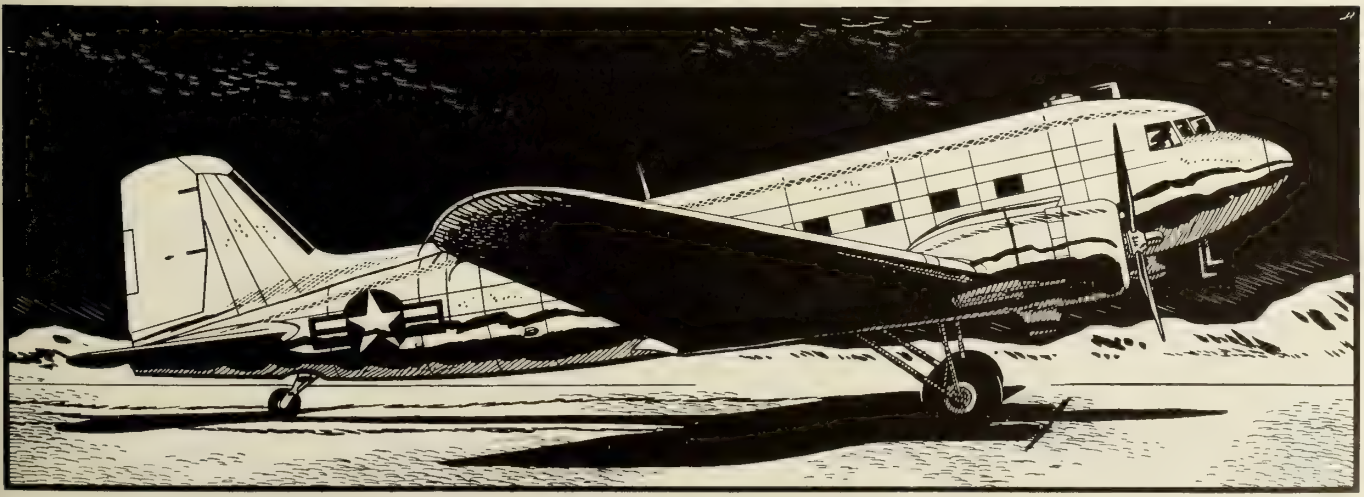
Capt. Myers' quick action and excellent judgment, coupled with his knowledge of existing facilities and conditions, enabled him to direct operations that saved the aircraft and prevented injury or possible loss of life to the crew. Well Done!



CAPTAIN
Roy E. R. Myers

60th T. C. Gp, Rhein Main, Germany

KNOWLEDGE . TRAINING



REX SAYS

I WAS NO. 3 in a flight of four F-80s and after taxiing into position and performing my runup, I released the brakes and started down the runway. After getting lined up I checked my instruments and found that I had only 96 per cent, even with full throttle. I then checked the instrument panel and noted that the emergency fuel system light was on.

I aborted at about 135 mph and was able to stop on the runway, although my brakes caught fire. I shut down and the fire crew came out and extinguished the smoldering brakes. I thought I had done rather well until it was called to my attention that the emergency fuel switch was in the UP or manual position. I had placed it there after my runup and then hurried through my cockpit check so rapidly that I didn't notice its position. Another case of being in too great a hurry and not checking everything properly.

I might add that since this near accident occurred I have been more than adequately briefed by my supervisors and you can be sure I won't get caught short again.

I LEARNED about fuel management the hard way on an air-to-ground gunnery mission when I flamed out on downwind leg.

I had started my last pass in an F-84E when the main fuel low-level warning light came on. My forward tank read full so I switched to forward auxiliary as I turned on downwind, and concentrated on the gunnery pattern.

Just before turning base the engine flamed out. I initiated airstart procedures with the alert switch ON, fuel selector on ALL TANKS and got a successful start. The main tank filled after I pushed the forward tank circuit breaker switch in. After that there was no sweat and I was able to return to the base and make a normal landing. Needless to say, now I keep checking fuel management procedures and my circuit breakers regularly.

***REX SAYS**—These lads came out smelling like a rose. You guys have got to learn those procedures and then put them into practice. Both pilots were lucky; you might not be.*

★ ★ ★

WE ARE ALL in this flying game together and a recent remark which I overheard on tower frequency the other day indicated that we're still looking out for the other airplane driver.

When taxiing out or holding for takeoff, I make it a point to have my crew follow the practice of inspecting the airplane ahead of them for any irregular items that may have escaped the notice of the other crew. Only once has an oversight been noted. This was a case of a landing gear down-lock still in place as evidenced by the red cloth streamer.

This time, it so happened that I was on the final approach when I overheard somebody inform the pilot of an airplane awaiting takeoff that an inspection door was hanging loose.

It was gratifying to me that this person-to-person touch, brief as it was, exemplified a common interest—safety in flight.

***REX SAYS**—Our brother's keeper. Reporting an incident like this might have prevented an accident. I'm for a guy who keeps a wary eye out for another guy.*

★ ★ ★

AFTER TAKEOFF from a small civilian field, the pilot of a Gooney Bird noticed that the airspeed indicator wasn't doing business. He and the crew chief discussed the situation and decided that the pitot cover had not been removed. The latter suggested that mayhap a bit of heat in the pitot head might burn the cover off. It didn't.

The driver then decided to attempt a landing. This didn't meet with any great amount of success as the old Gooney got to bouncing and, as the pilot zigged when the plane

". . . I aborted at about 135 mph and was able to stop on the runway, but the brakes caught fire."

zagged, the porpoising action got pretty severe. Finally the throttles were opened and at this point the pilot decided to continue on with the flight as planned.

After about two hours of flying through heavy turbulence the plane was brought in for an emergency landing. This time the touchdown was successful. The crew had had enough.

Getting back to the beginning of this little fiasco, the pilot had instructed the crew chief not to remove the rudder lock until he was in the cockpit and holding the rudder pedals. The pilot made a quickie-type walk around and leaped aboard. The airman was stationed by the tail. Nobody remembered the pitot cover.

REX SAYS*—This is hardly worth commenting on. This lad must belong to the old school of tire-kickers, though fortunately there aren't many of them around any more.*

★ ★ ★

I DON'T HAVE any claim to fame nor do I want my name on a Form 14. But due to a very helpful passenger, I almost scored on both of these counts.

I'd been manifesting this airman all the way across the States. He was on leave. He got chummy with the crew chief and at times had helped him put the control locks on and such.

So what happened? We landed, all the crew walked into base ops and, without further ado, the passenger proceeded to put on the rudder control lock. A short time later, instead of making with the visual preflight routine, I just climbed in and taxied out to the active runway. I checked the engines, received my clearance, looked to see if all of the passengers were buckled down and took the runway for takeoff.

About 100 yards down the runway I needed some right rudder. What's this? No rudder? Again I kicked. Nothing.

I chopped the throttles, did a dancing act on the brakes with accompanying throttle manipulations, averted a groundloop and came to a stop.

Shamefaced, I knew what had happened. I had failed to go through the perfunctory flight control freedom-of-movement exercise. As for the passenger, the sergeant nibbled, the copilot masticated and I chewed.

"I keep telling Gridley all he has to do is fasten his chin strap."

REX SAYS*—Must have been a real calm day, otherwise maybe a little rudder-brake combination while taxiing might have detected this immobility. As to the passenger—bet he is still eating from the mantel.*

★ ★ ★

I'M IN THE IP business, flying cadets in B-25s, and over the years I've withstood the usual and the unusual when it comes to situations. But I witnessed a near-tragedy recently that chilled the marrow of my bones. I thought I'd pass it along to Rex because it could happen to anybody, anytime, anywhere.

It was a local night flight. Two parallel runways were in use, with planes performing both full stop and touch and go landings. One B-25 was cleared for a blackout, touch and go and had landed, completed his check and had power on, moving down 17L.

Another B-25 had made a full stop landing on 17R and was taxiing up another unlighted runway, preparatory to crossing 17L, and then return to the runup spot.

The tower operator evidently had given the taxiing B-25 permission to cross 17L, so he started out on the runway. Once out on the strip, he saw the oncoming B-25 and immediately applied full power to cross.

The oncoming B-25 at the same time evidently saw the taxiing aircraft. But too late. The pilot of the B-25 on takeoff run chopped the power and applied full right brake and rudder. Instead of a head-on collision, his wing nipped the rudder of the taxiing B-25. Whew!

After seeing this foul-up, I thought of some points that, if observed, would have prevented this mishap:

- Taxi with lights. That's what they're for.
- Use a lighted runway for taxiing. If unlighted, have the tower operator turn the lights on.
- Be sure the tower operator knows your position on the taxiway or runway at all times.
- Keep your head on a swivel.
- Unless the mission requires it, or the weather is sour, use landing

Rex Says

lights for night landings. It helps the guy on the ground to see you.

REX SAYS *— Amen. I'll buy this light and tower talk. Too many of us are content to tool down the final with nary a thought as to what's going on downstairs. Also, it's a must to keep an ear tuned to the tower for any emergency that might arise.*

★ ★ ★

I HAD FILED an IFR flight plan and was getting ready to go out to my T-Bird when the dispatcher asked me if I could take a passenger. He turned out to be an RO, so I figured there should be no sweat on any procedures.

After we got out to the plane I went over oxygen procedures with him and he seemed to be fully briefed. He had his own helmet and mask and after he climbed in I checked to see that he was hooked up. Everything looked okay so I started up and we took off.

Prior to departure, we both had 100 psi of oxygen and it was feeding normally. At 35,000 feet the cabin pressure was indicating 29,000 feet. About 45 minutes later the passenger complained of hypoxia and began to choke. I descended immediately to 20,000 feet, which put the cabin altitude at 15,000 feet. There was approximately 225 psi oxygen as I started descent.

At this altitude, the RO stated that he felt better, but that his extremities were completely numb. I made an emergency landing at an Air Force base and he was taken to the hospital for observation.

A check of his oxygen mask revealed that it fitted him loosely. Perhaps I should have checked it more carefully before takeoff, but it seems to me that a rated man should know enough to have his personal equipment properly fitted and checked regularly.

REX SAYS*—I've got to go along with that. Your passenger definitely was at fault. In fact, he was a walking casualty looking for a bed, and found it. Trouble is, unless you're sure of your man, it still is best to know, by checking, whether a passenger is informed on all procedures.*

★ ★ ★

I WONDER how many other well-meaning, conscientious pilots in the Air Force unintentionally violate a certain VFR flight regulation which might result in a nasty, head-on collision?

I was on a VFR flight plan, heading up a northeast, numbered airway. It was about dusk. I was sitting back, fat and sassy, flying the correct quadrantal altitude.

Lucky for me, my copilot was a perceiving cuss and all of a sudden he overpowered me and we changed course to the right awfully fast. This snapped me out of my lethargy just in time to see a red light zip past the side of our aircraft.

I immediately berated the obvious offender who had just flashed by and was all for trying to get a rundown on him. Why didn't these guys, who churned up the ozone for their livelihood, pay attention to their headings and altitudes?

About this time, Joe Copilot interjected a thought. Are we at the right altitude or was the other fellow flying at the right altitude?

So we flipped open the Supplementary Flight Information book and checked the abbreviated 60-16 flying regulations.

It said, under paragraph 32d, "In control zones and control areas, altitude will be as specified for the direction of flight for airways concerned. Elsewhere, wherever practicable, an aircraft will be flown at an altitude above sea level appropriate to its magnetic heading . . ."

I grinned sheepishly and started a climb. I felt properly chastised and thankful to my copilot for his prompt change in course.

REX SAYS *— One more accident averted. But he brings up a good point. Don't forget that when you fly VFR on airways, maintain that odd or even altitude like the Fac Chart says. Then if you go off airways, use the well-known quadrantal separation rule.*

★ ★ ★

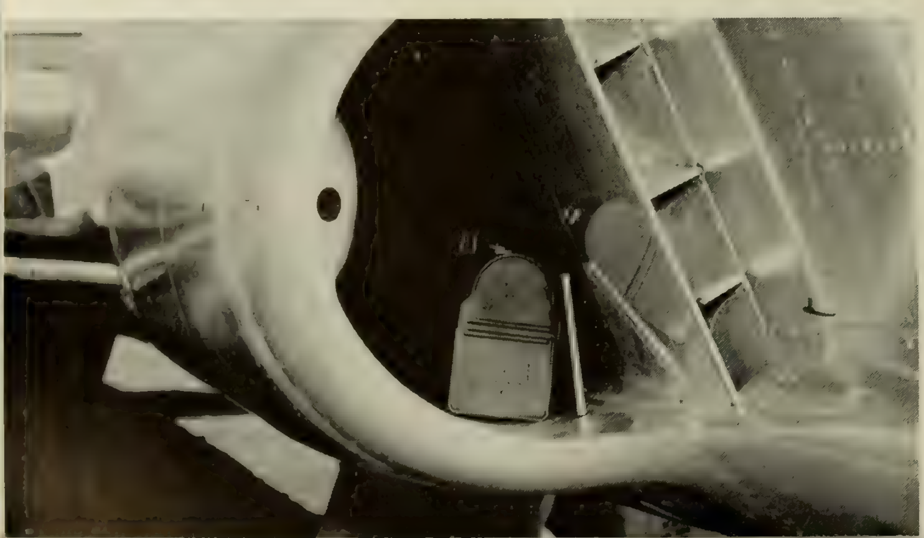
WHILE STROLLING around the line not long ago, I came upon a rather amazing spectacle. And since I had my trusty Brownie slung over one shoulder, I thought I'd better record it for posterity just in case someone might question my veracity when I told the tale.

When I showed the picture to some of the troops, a bright soul suggested that I send it in to old Rex. Please note that this dude not only stashed away his lunch in a nice, dry place but he even brought a book to read. Grimm's fairy tales, no doubt.

A little inquiry turned up the information that the lunch hider "Always put his lunch there, so the other fellows wouldn't steal it." *He did, but he don't anymore.*

REX SAYS*—Probably wanted a hot lunch. It's a seven-day wonder he didn't try to retrieve it just about the time someone started the pipe to burning for a flight.*

This mania for hot food at lunchtime seems to be reaching fantastic proportions.



★ WELL DONE ★

KNOWLEDGE . TRAINING

1st LIEUTENANT

Norman Schmidt

4927th Test Sq, Kirtland AFB

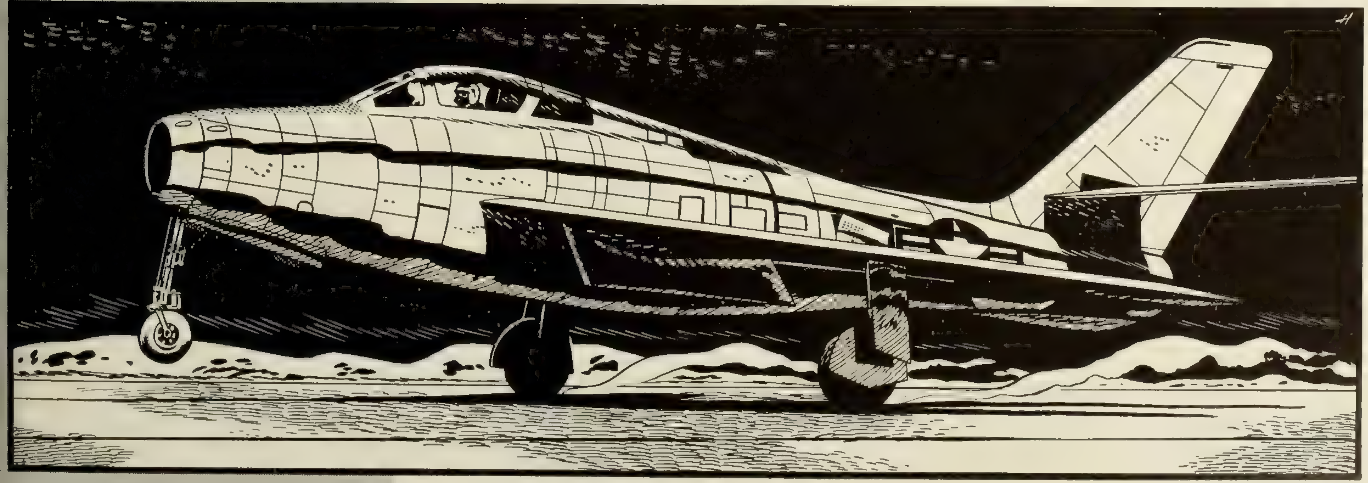
AFTER COMPLETING a local test mission in an F-84F, 1st Lt. Norman Schmidt entered the landing traffic pattern at Kirtland Air Force Base. He called on the break and placed the gear handle down, however the left main gear would not lock in the full down position. Lt. Schmidt immediately left the traffic pattern and attempted to obtain a safe gear indication.

He employed all of the emergency and normal extension procedures, including rocking the wings and performing accelerated maneuvers. However, the left main gear still would not lock in the down position.

With only 300 pounds of fuel remaining, Lt. Schmidt decided to try to jar the left gear down by bouncing the right wheel on the runway. The aircraft touched down well above stalling speed and after the third bounce the left gear locked down.

There was not sufficient runway left to permit a safe landing, so Lt. Schmidt accomplished a go-around and pulled up into a tight rectangular traffic pattern. As he turned onto the downwind leg the engine flamed out due to fuel exhaustion. He had anticipated this possibility, however, and had maintained adequate airspeed to perform a power-off approach. The landing was uneventful and no damage was incurred to the aircraft.

Lt. Schmidt's accurate appraisal of the emergency, his ability to foresee and plan for complications and his outstanding flying skill are a credit to himself and to the U. S. Air Force. Well Done!



ANNUAL INDEX

1955

This year's index has incorporated an addition that should meet with your approval. You'll find, below, that articles are listed as to aircraft type for quick reference. On the opposite page is the regular index.

As a suggestion, you might tear out the index and paste it on the outside of your loose-leaf binder or cover sheet of your copies of the magazines.

★ ★ ★

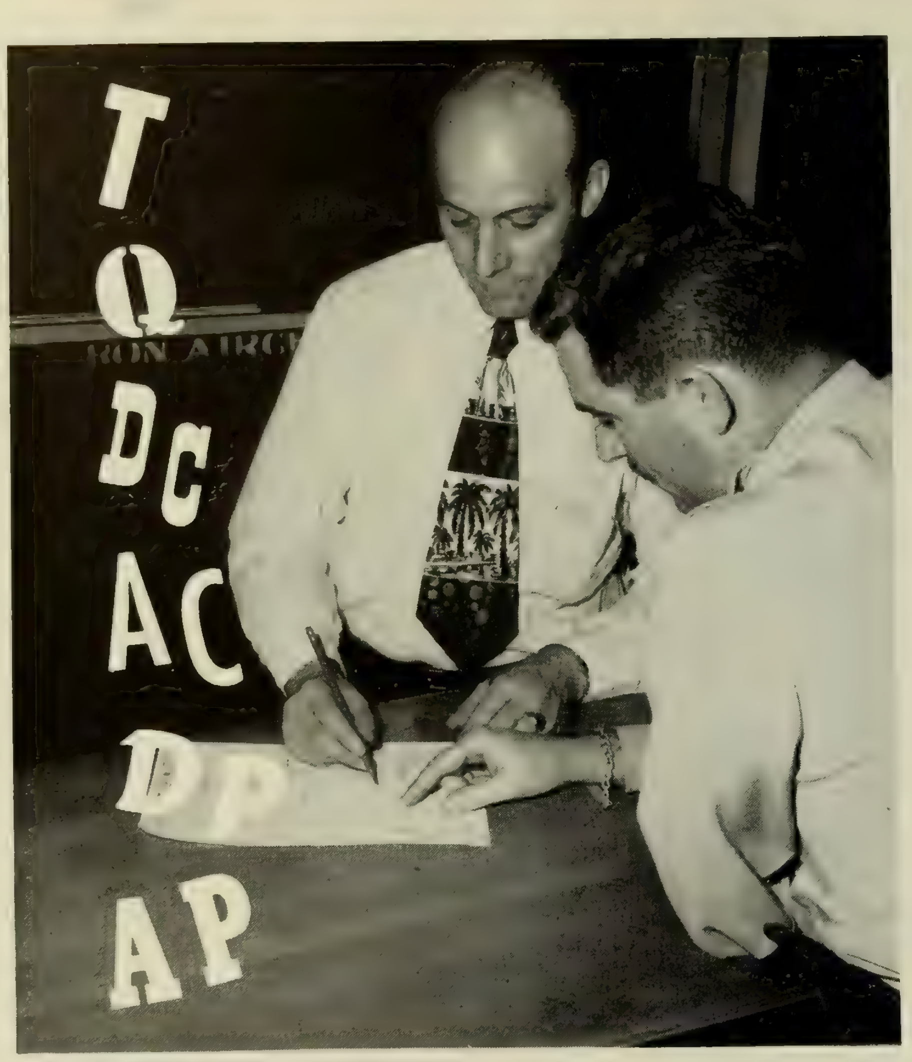
Articles on Aircraft

Type	Title	Month	Page
F-84	Flying the F	Jan	8
	Goof and Live	July	28
	Winding Up the F	Sept	26
F-86	Spinning the Sabre	Jan	11
	Rag Drag	Feb	20
	The Soft Touch	Aug	10
	Dog In the Drink	Nov	10
	The Edge in Performance	Nov	22
F-89	Do's and Don't for D's	Jan	2
	The Rugged Scorpion	May	10
F-94	The C Around You	Jan	5
T-33	Rag Drag	Feb	20
B-26	For Loss of a Bolt	June	20
B-47	After You're Down	May	20
B-52	The Plan Behind the Plane	Jan	16
B-57	Swift Blackbird	June	4
C-123	Rugged but Right	May	4
C-124	Big Brute Technique	Feb	12
	Straight Thru to Kyushu	Sept	4
	Shakedown Artists	Nov	4
KC-135	A Preview of Tomorrow's Tanker	Sept	12
EC-121	The Sky Is Their Beat	Dec	4

FLYING SAFETY Annual Index, Volume 11, 1955

Topic	Month	Page
AIRCRAFT		
Do's and Don't for D's	Jan	2
The C Around You	Jan	5
Flying the F	Jan	8
Spinning the Sabre	Jan	11
The Plan Behind the Plane	Jan	16
Big Brute Technique	Feb	12
Rag Drag	Feb	20
Looking at the Maching Birds	Apr	4
Rugged but Right	May	4
The Reluctant Scorpion	May	10
After You're Down	May	20
Swift Blackbird	June	4
A Preview of Tomorrow's Tanker	Sept	12
Winding Up the F	Sept	26
The Edge in Performance	Nov	22
BARRIER, CRASH		
Big League Catcher	Aug	14
COCKPITS		
Designing the Office	Feb	26
DITCHING		
Chilled and Chattering	Aug	21
Dog in the Drink	Nov	10
DESIGNS, AIRCRAFT		
It's Just a Case of Plus and Minus	Jan	18
Straight and Swept	Jan	20
ENGINES AND PROPELLERS		
Shift to High	Feb	10
What's the Percentage?	Apr	26
Stop the Stalling	May	16
By the Numbers	Sept	16
Hazards Can Be Hidden	Oct	16
The Wrong Side of the Curve	Oct	26
Whoa Fans	Feb	2
Reversal in Flight	Feb	5
HAZARDS—WEATHER		
Concrete Ski Trails	Feb	28
Get the Full Treatment	Mar	19
The New Approach to Rough Air	Mar	24
Fellow Travelers	Apr	18
VFR—Foggy Facts	May	28
Summer Flying Hazards	June	14
Big Wind Scurry	July	14
The Low Down on High Up	Aug	18
Frigid Flying Safety	Oct	2
Just Plane Busted	Nov	14
INSTRUMENTS		
From Oh to Zero	July	4
The Pointer in the Case	Oct	14

Topic	Month	Page
LANDINGS		
Give 'Em a Break	May	23
That Magic Area	July	22
Hazard or Aids?	Aug	2
The Soft Touch	Aug	10
MISCELLANEOUS		
LOX	June	28
Stand-by One	Aug	12
The Thundering Heard	Aug	26
Straight Thru to Kyushu	Sept	4
The Little Drifter	Sept	20
Sentinels in Mukluks	Oct	20
New Defense Areas and ADIZs	Dec	14
Chatter from the Fishbowl	Dec	16
Send a Letter	Dec	28
NAVIGATION AND NAV-AIDS		
Lost-Displaced-Disoriented	Mar	4
Tomorrow's New View	Mar	20
When You're in the Soup	Mar	26
Extra Omni Angles	May	26
PERSONAL EQUIPMENT		
Is It Working?	Mar	12
Round Trip Ticket	Apr	14
Snap That Strap	Dec	9
PILOT, CONDITION AND REACTION		
Fit to Fly	Jan	24
Smoking Facts	Feb	18
Nothing Ever Happens To Me	June	19
PUBLICATIONS		
On Course With 60-16	Apr	25
Danger—Missiles at Work	Apr	28
A Winning Hand	Nov	16
SAFETY, FLYING		
You—Safe—Co-op	Apr	20
For Loss of a Bolt	June	20
Shakedown Artists	Nov	4
From Spangdahlem to Kisarazu	Dec	12
SIMULATORS		
Tiger Trainer	Mar	16
Situations Unlimited	Apr	22
Goof and Live	July	28
SURVIVAL		
It's Better When You Help	June	24
Helping Hand	July	16
Snowy Classroom	Oct	25
I Plan to Survive	Nov	12



Send a Letter

IF THE LETTER groups on the left side of this page make sense to you, then you fit into a rather select group. Right now, only about 10 per cent of all Air Force pilots know the meaning of these additions to the remarks section of the Form 175, or bother to use them.

After you circle or add one or more of these coded letters, Flight Service transmits them to your destination. There they are transformed into information such as your fuel and transportation requirements, passengers or cargo aboard and so on.

A screening of hundreds of Form 175s disclosed that the remarks on some have bordered from the ridiculous to the sublime. Probably you can remember some dillies you've contributed.

Another factor was revealed from discussions with tower operators worldwide. It seems that practically all pilots, regardless of the type of aircraft flown, put in their bids for fuel and transportation after they receive landing instructions.

The large accumulation of these discrepancies resulted in a simplified letter coding system. It is designed to relay information on passengers or cargo, as well as other data needed to expedite movement at destination.

There is no need to commit these letters to memory for any base ops dispatcher can run down the list in 30 seconds. But have a look at them anyway. Often times a first exposure jolts a pilot into learning.

S—Servicing only.

T—Transportation. (The number of persons requiring transportation will follow the T. Thus, T20 indicates that 20 persons will need transportation.)

Q—Quarters. (The number of quarters for officers and airmen will be separated by a slash. Thus, Q4/20 stands for four officers and 20 airmen. If only airmen need quarters, the correct code will be Q/20.)

R—The aircraft will remain overnight at the destination indicated in the flight plan.

DC—Will discharge cargo. (A number immediately following DC will indicate the quantity. The last two zeros will be dropped. For instance, DC40 means 4000 pounds.)

AC—Can accept cargo. (The above paragraph concerning the zeros is applicable.)

AP—Can accept passengers. (Number following AP indicates the number of passengers acceptable.)

DP—Will discharge passengers. (Number following DP indicates number of passengers to be discharged.)

NP—Need parachutes. (Thus, AP 5NP3 indicates the aircraft can accept five passengers if three of them have parachutes. If no parachutes are needed, no NP is entered.)

TIK—Location identifier indicating the first intended destination on the next leg of the flight.

Automatically, a pilot's reaction to this seemingly complicated code is to shake his head, mutter under his breath, sign his clearance and stroll out to his machine.

In practice, most dispatchers will go through a quick rundown of the letters with pilots and summarize the entire code in less than a minute's time. Simply by circling the appropriate letter, a passenger can get a lift, a load can be prepared or other information can be sent.

A lot of base ops sections have added these letters to the Form 175s. A follow-up with solicited comments from assigned and transient crews reveals that once a pilot understands the purpose behind the coded letters, he is willing to go along with it.

As the signs outside most air bases say, "Give a serviceman a lift." Why not go it one better and "give everybody a helping hand—correctly." ●

A TIME FOR REUNIONS

The Christmas season is the season for reunions . . . the time when many transients will be asking, "May I ride with you?" You, of course, will want to help out, but never forget your responsibilities as a pilot. Be just a little more careful than usual and take time to brief your passengers thoroughly.

Make this Yuletide a safety climax to 1955. Plan your Flight, Fly your Plan and make this a Merry Xmas for all.

Driving reindeer as Mr. Whiskers,
Mal controls these hairy friskers.
To stay on schedule on world-wide flight,
Antlered critters get refueled all night.
Waves Merry Christmas with good cheer
And best wishes for coming year.

629.1305
FLYS

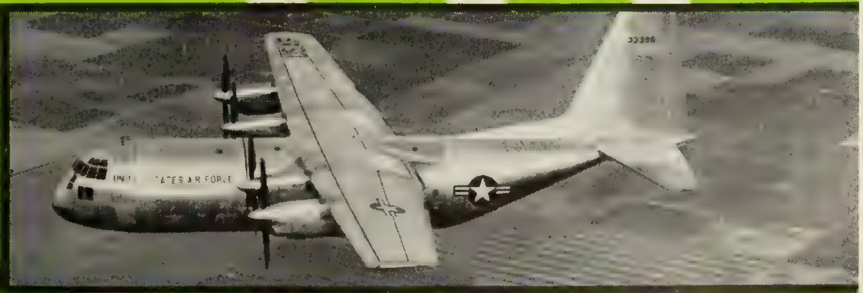
FLYING SAFETY

UNITED STATES AIR FORCE

JANUARY

1956

WHAT THIS YEAR HOLDS FOR YOU



FLYING SAFETY

VOL. TWELVE NO. ONE

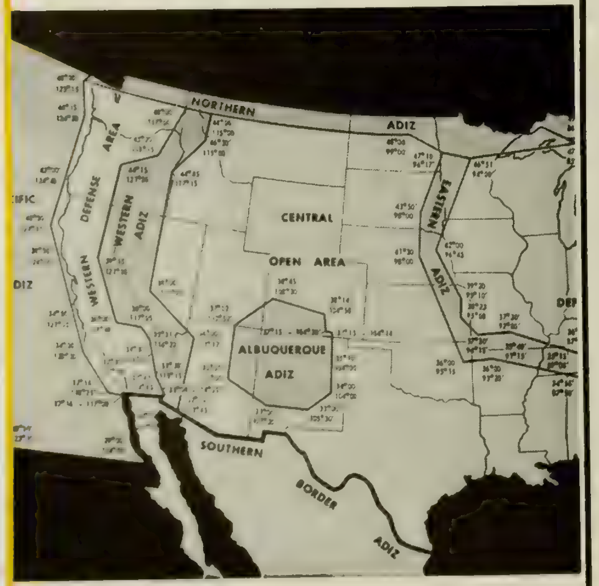
★

ADIZ SPECIAL

- One of the new ADIZ procedures needs some clarification. FLYING SAFETY (Dec. 1955), along with a few others, misinterpreted a paragraph in the new AFR 60-22. We believed that flights originating in the Western or Eastern ADIZs and flying towards an open area, were exempt from the IFR-DVFR requirement, provided they would not penetrate the Albuquerque ADIZ or the Northern ADIZ. THIS IS NOT CORRECT!

- *Regardless of the direction of flight, if you originate in the Eastern or Western ADIZs, you must file either IFR or DVFR.*

- FLYING SAFETY suggests that you get the map printed in the December issue, and a copy of AFR 60-22, dated 24 Oct 55, and familiarize yourself with the new areas and procedures.



Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

STAFF

Editor
Major Perry J. Dahl

Managing Editor
Captain John H. Moore, Jr.

Associate Editor
Maj. Jesse F. Townshend, Jr.

Art Editor
M/Sgt. Steven Hotch

PRODUCTION

Major Ben H. Newby
T/Sgt. Nicholas Shekita, Jr.

T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune

T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

Page

Safety—A Product of Supervision 2
Real Cool Landings 4
Well Done 9
Ozone Expediter 10
Keep Current 14
What Are the Odds? 16
George Turns Tiger 18
The Good Old Daze 22
A Roll of the Dice 24
Rex Says 26

★ ★ ★

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

LETTERS TO THE EDITOR

Getting the Facts

In the October "Well Done" there seems to be an error. With a complete electrical failure we wouldn't have the needle-ball nor would we have use of the alternate flight control system.

I believe that the failure must have been a failure of both generators rather than a *complete* electrical system failure.

I would like to point this out so that other F-86D pilots will not be confused. I think the "Well Done" was well earned.

We have used numerous FLYING SAFETY articles in the All-Weather Interceptor courses here at Perrin and think you do an excellent job.

Albert B. Haley
F-86D Eng. Instr.
Perrin AFB, Texas

You are so right. It was failure of both generators. Thanks for straightening out our terminology.

★

Sleep at Last

Referring to the August issue of FLYING SAFETY generally and the "Keep Current" section specifically, meaning "Approach Chute," may I quote but not agree with you in the following statement: "The landing speed of the B-47 jet bomber has been considerably reduced through the use of the approach chute." It just ain't so! However, the approach chute does increase drag requiring a pilot to maintain higher engine RPM in order to fly correct approach speeds throughout the entire landing pattern.

By permitting higher engine RPM without a build up of airspeed, the approach chute enables a pilot to adjust rate of descent more readily and to accelerate the engines more rapidly if a go-around is necessary. That is the what and why-for, but the landing speed, approach speed, cruise speed, touchdown speed and all the little speeds remain the same, including the stall speed.

Now that this is settled I can sleep nights. Good night!

Capt. Robert A. Gromm
442d Bomb Sq, 320th Bomb Wg
March AFB, Calif.

Good night. Thanks a lot. We dig you the most.

★

Rocky Reminder

I would like to toss this thought into the pot and see if it has any merit or could be utilized for any field which has the same landing problems as we do here at good old Wright-Patterson AFB.

Recent gear-up accidents at this base indicate that pilots are still not complying with instructions to read the checklist prior to landing or are relying on control tower operators to tell them they have neglected to lower their gear.

Since there is generally a reasonably flat area leading up to and along each side of the approach end of the runway, why not use a "rock garden" effect and spell out the slightly provocative phrase, "Gear Down?" in words five to ten feet high? Boulders of suitable size, either whitewashed or painted with fluorescent paint, would do the job.

To keep the rocks from being lofted out of their assigned resting spots by the first aircraft which may point its tail that way, I would suggest using a concrete bed. Regular painting may be a necessity, but since paint is less expensive than airplanes, one accident averted will be more than worth the cost.

Capt. Walter E. Johnson
Flight Facilities Officer
Wright-Patterson AFB, Ohio

Sounds like a real going idea. A snow removal gang might have a little trouble sweeping around the rocks though. We are interested to know if any outfit has tried this idea? How about hearing from you, if you have?

★

A Piece of String

I read with a great deal of interest and appreciation your article in the October issue on "Live in Cool Comfort." I would like to add to it the reminder that there is no worse thief than snow.

Once you drop something, unless it is large, it is an almost impossible task to find it again. A piece of string with which you can tie small articles such as your knife, flashlight, mirror and safety matches to your belt is a really important item to carry in the emergency kit.

Col. Charles H. Morhouse
USAF (MC), Hq 3rd AF
APO 125 New York City

You're so right. Something akin to looking for the needle in the haystack routine. We concur that a piece of string is a "must" for the little handy-dandy kit.

SAFETY a Product of Supervision

Colonel George L. Holcomb,
Director of Flying Safety, TAC

FLYING SAFETY is a product of many things, but primarily it is a product of supervision. Without supervision there can be no order. Without order there is chaos.

Admittedly, the above makes a mighty big case for supervision, something which is very difficult to define or explain, but which I believe to be the most important single factor in the prevention of aircraft accidents. Although figures show that most accidents are charged to the actual operator of the aircraft, a thorough study of all accidents would reveal that in many cases the operator was merely the last one to make a mistake and that somewhere along the line, persons in supervisory positions had erred.

Let us examine a hypothetical situation. A flight of two aircraft has just crashed while on a night instrument formation flight. Working backward from this tragic and costly climax to what should have been a routine operation, we find this.

The briefing given by the flight commander was inadequate. The operations officer had ordered the flight out under conditions which were beyond the capability of the flight leader. The squadron commander had no policy, in writing or otherwise, which outlined the qualifications necessary to lead flights under various conditions and circumstances. The group commander had not laid down a definite, clearcut policy on the selection of flight leaders. He neglected this because differences of opinion existed within the group as to the qualifications necessary and the method to be used to designate those pilots who might lead flights under various conditions. Finally, higher headquarters had committed the unit beyond its capability without knowing it.

This accident did not just happen. It was caused. It was caused by failures of people who could have prevented it. Although it is the immediate supervisor who is directly responsible for what his people do, staff agencies and commanders must assume some responsibility—for planning and directing, for discovering and correcting weaknesses which may lead to trouble. Supervision extends throughout the command and staff structure of the Air Force, and like that old familiar link in the chain, when one supervisor fails, there is a potential accident in the making.

What is supervision and why is it so important in the prevention of accidents? Supervision is sometimes referred to as leadership, but more often perhaps it is simply management. In the Air Force it might be called military management. In industry the job of management is to produce for profit. In the Air Force the results of management may be so important as to be measurable not only in dollars but in terms of cities, large troop or fleet concentrations or even in terms of entire nations or present-day civilizations.

★

Col. Holcomb is well qualified to discuss the subject of supervision. A graduate of the U. S. Military Academy, he has served as a base commander both overseas and in the States during WW II and in Korea. In addition, Col. Holcomb was Chief of the Military Management Division of the Air Tactical School, headed the committee which prepared the curriculum for the first Squadron Officers' Course at the Air University and was a faculty member of the United States Military Academy.

Management in industry has long since learned that the most efficient method of production is also the safe method. No quarrel can be found with that conclusion and the Air Force can no more afford the losses resulting from the use of inefficient or unsafe methods than can industry.

Supervision means planning—planning based on a thorough analysis of the job to be done and an accurate appraisal of the tools to be used. Without planning there can be no direction or control. The path to the goal must be charted clearly, proper procedures must be established to guide the way and everyone must know where he is going, how he is to go and why. In all of this planning the principles of safety must not be overlooked. Safety does not just come naturally. It must be planned.

One of our biggest problems in this day of complex machines, high speeds and altitudes, is the ability of the human to keep ahead of the machine. Haste easily can make waste, and unnecessary speed in training easily can be too expensive in materiel and manpower lost through aircraft accidents.

I once read an article entitled "How to Eat a Steer." The point of the article was that a man can eat a

Many different aircraft fly under the TAC banner, among them being the C-123, F-84 and B-57. Proper supervision entails constant monitoring.

steer, one steak at a time, but if he is required to devour the entire animal at once, he will get indigestion. This may be likened to the danger of getting mental indigestion if required to absorb too much information at one time. One of the jobs of supervision is to see that the training program is broken down into "steak size chunks" so that the trainee can digest each chunk without ill effects.

Supervision means directing. Rules and regulations set standards and establish procedures, but they do not prevent aircraft accidents any more than traffic laws and speed limits prevent automobile accidents. Only the closest supervision can insure the continued use of proper procedures on the part of personnel involved in the maintenance and operation of our increasingly valuable aircraft.

How each supervisor should go about getting this necessary cooperation of his people is a problem which only he can solve. Normally, he cannot do it by order or threat. He can best do it by obtaining the confidence of his people and by setting a proper example himself. People follow people in whom they have faith, sometimes to their own detriment. They become blind to the faults of the man in whom they have confidence and they are easily led, or misled, by him.

Young pilots are impressionable. They will usually do what they think their supervisor wants, particularly if they have confidence in him. This places a great responsibility upon the supervisor, because if he wants a "daring" or "tiger" attitude in his charges, he will usually get it. Unfortunately, some of his followers may not be ready or capable and the results may be disastrous.

The supervisor who has the confidence of his people is likely to be the first, even before the chaplain or the flight surgeon, to know of current or impending personal problems. A wrench in the hands of a worried mechanic can be an instrument of destruction. A pilot with heavy domestic or financial problems is a hazard to himself and to others who fly with him. The supervisor has the best chance to discover and to eliminate this accident potential.

Supervision means controlling. It is not enough to plan an operation. establish procedures and place someone in charge of implementing those procedures. Checks must be made to determine whether the operation is proceeding as desired and corrections or modifications must be made in time to bring operations into line with the plan as revised.

Persons in supervisory positions must be able to recognize unsafe practices, flaws in procedures and hazardous conditions. In the interest of safe operation it is often necessary to do many things which were not a part of the original plan, such as altering training programs to emphasize certain phases, grounding or otherwise restricting the operation of aircraft or restricting pilots and crews to certain types of operations.

Up to this point I have been talking primarily about supervision from above. Now let me discuss briefly one other kind of supervision from which none of us can hide, self supervision. This is simply self discipline—knowing one's self and one's own capabilities and limitations, taking advantage of every opportunity to increase one's capabilities and practicing correct procedures until they can be performed as mechanically and as smoothly as Sam Snead's golf swing.

It means complete personal honesty and integrity and a loyalty to others which will transcend self and which will make a man admit a mistake or report a hazardous condition or unsafe act, even though such a report may reflect unfavorably upon himself or upon a friend. The pilot who fails to write up an engine which overspeeds to 111 per cent just doesn't have it. Neither does the squadron commander who reports that his pilots are ready and qualified for a particularly difficult mission when he knows full well that they have not been adequately trained for that mission.

Someone has said that "aviation in itself is not inherently dangerous, but, like the sea, it is terribly unforgiving of any carelessness, incapacity or neglect." Proper supervision can and will greatly reduce the incidence of carelessness, incapacity and neglect in the maintenance and operation of aircraft, thereby contributing materially to a safer and more efficient operation. ●

Note the contrast between the shelf ice and Arctic Ocean pack ice. You could land here.

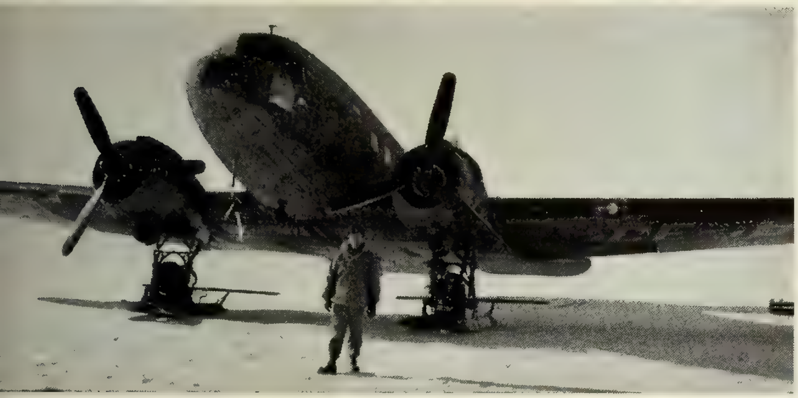
Real Cool Landings

Lt. Col. Donald A. Shaw
ADTIC, Maxwell AFB, Ala.

THE CHANCES ARE that someday you will fly in the Arctic. Your flights will take you over vast expanses of snow and ice. The many airfields with their paved runways, towers and maintenance facilities to which you have been accustomed in Stateside and foreign flying will be missing. In their place will be vast areas of ice and snow, the surfaces of which may be your only available landing strips.

Probably you have read of emergency landings on ice in true and fictitious adventure stories and have been influenced by hair-raising accounts of arctic adventures. You may believe

A C-54 rests safely at Cambridge Bay, N.W.T. Strip later was used by C-74s which grossed at about 130,000 pounds.



For ski or skid aircraft, practically the entire Ice Cap above 5000 feet elevation can be used for an emergency landing area.

The rule for landing on the Cap should be wheels up. Wiping out the gear or flipping over on your back can be very risky.

that landing an aircraft on ice is an activity closely akin to circus or stunt flying. Plain facts, unadorned for dramatic appeal, reveal a more interesting story—a true story which may help you in an emergency and in performing your mission when and if you ever fly in the Arctic.

Ice can be classified into one of three major categories: Land ice, sea ice and fresh water ice. Land ice also is known as glacier ice. It is formed by snow accumulating on a land mass to such thicknesses that the weight, pressure and seepage of melting water from the upper mass changes the snow in the lower mass to ice. Pressure from within the mass and gravitational pull cause tongues of ice to move outward from the mass. These tongues are known as glaciers. The icebergs found floating in salt water originate from glacier or land ice. They are chunks which have broken off into the sea from the main mass of land ice and have been carried away by current and wind.

Sea ice is any ice formed from salt water. Of the many forms of sea ice, large floes, which look like huge pieces of a jig saw puzzle, make the best landing areas.

Frozen leads are wide cracks which have opened in the ice and refrozen with a smooth surface. Shelf ice is so called because it extends outward from the shore to which it adheres, and may have been formed in part by the freezing of fresh water from the land. Immense pieces of shelf ice found drifting in the Arctic Ocean are known as ice islands.

Bay ice and fast ice are formed from salt water confined to sheltered bays or adhering to at least one or more shores. Pack ice is conglomerate ice found in the sea which has been broken up by wind, current or pressure. The pieces may float free or be frozen together. Both icebergs and ice islands are found in the far north pack ice.

Fresh water ice is found on lakes, ponds and rivers. Ice on most arctic lakes grows to great thicknesses and is stronger than salt water ice.

Snow Cover Difficulties

Generally, wherever ice forms it is covered with snow, which must be removed or compacted for most operations. The snow cover makes it difficult to select an emergency landing spot on the ice. It hides the color and the small cracks which give some indication of ice thickness. Ice thickness seldom can be determined accurately from the air. (If you are so familiar with the area you are flying over that you know the local conditions influencing ice formation there, you can often estimate its thickness.)

However, you can obtain a good estimate if you can fly low enough over a place where the ice joins open water by judging the height of the ice edge above the water or from the thickness of an upended floe. Sufficient observations have been made during the past 10 years to forecast approximate average ice thicknesses for many areas at a given time of the year also.

In addition, sea ice suitable for emergency landings can be found in the Canadian Arctic from December through May, but the sea ice of the east coast of Canada is more difficult to estimate because its rate of growth and thickness is less than in central Arctic Canada. Fresh water ice forms somewhat earlier, but lakes usually are surrounded by mountains.

Greenland sea ice is generally treacherous because wind action breaks it up and sweeps it out of the bays before it thickens sufficiently, but in Greenland you have the ice cap available to you the year round.

Alaska is so mountainous that good emergency sea ice landing fields may be found only off the north and northwest coasts. However, in southeast Alaska, aircraft have landed in large fields of land ice.

In the Arctic Ocean, good floes of ice may be found at any time of the year and shelf ice is available along the Ellesmere Island coastline. Ski aircraft have landed safely on the winter ice of Ellesmere Island's Lake Hazen as late as July.

Early polar explorers such as Byrd, Amundsen, Wilkins and many others, including the Russians, used ice as landing areas as a matter of necessity. Their aircraft were equipped with skis and they judged the strength of the ice for landings by experience and guesswork. The bush pilots of Canada and Alaska have landed aircraft on ice for 20 years or more. To them it is a routine operation.

Rescues Spur Interest

As a result of these successes, USAF interest in the use of ice for landing aircraft has increased markedly in the last decade. About 1946, after several successful conventional wheel landings on ice had been made for rescue purposes, interest developed in the possibility of using ice landing strips for special projects in arctic regions which could not be supported by surface transportation. But long-range transport aircraft were so large and heavy that operational people wondered if any arctic ice was thick enough and strong enough to support these great weights.

The Arctic, Desert, Tropic Information Center, Air University, USAF, had collected some data on ice-bearing strength from Russian and other sources during World War II. The Arctic Construction and Frost Effects Laboratory, Corps of Engineers, USA, subsidized by Air Force funds, began to study and experiment with construction and maintenance of airdromes on ice. Later the Snow, Ice and Permafrost Research Establishment, Corps of Engineers, USA, the U. S. Navy Hydrographic Office and the Air Research and Development Command conducted experiments on ice-bearing strength and on instruments for measuring ice strength.

The strength of fresh water ice at different temperatures is comparatively easy to determine. The strength of salt water ice is much more difficult to assess. As physical action within the ice constantly changes its strength, tests have to be made approximately every 12 days to measure its bearing strength. Based on these approximations some remarkable air transport operations involving ice landings have been carried out by the USAF in the Arctic.

The first of the large airlifts using ice landing strips was the Beetle Project of 1947, during which 1100 tons of supplies and equipment were flown from Canadian air bases to remote arctic locations to establish LORAN stations. The landing strips at these stations were on smooth bay ice. Most of the landings were made by C-54 aircraft grossing about 68,000 pounds, although some C-82 aircraft were used. The heavy equipment that could not be carried in a C-54 or C-82 had to be airlifted to Cambridge Bay, Victoria Island, N.W.T. An aircraft larger than a C-54 had never landed on ice and the thickness necessary to support a heavier aircraft never had been determined. Not enough data on ice strength were available to figure out accurately the minimum thickness required for aircraft heavier than 45,000-50,000 pounds landing weight.

C-74 Lands Safely

General William H. Tunner, then Commander, Atlantic Division, Air Transport Command, made the decision to attempt a landing with a C-74 aircraft at approximately 130,000 pounds landing weight. According to existing data on ice strength at that time, a C-74 at 130,000 pounds landing weight would require at least 80 inches of young sea ice (sea ice less than one year old) to support it; and some estimates ranged upward to 123 inches, depending on the data used. A few authorities were certain that the 86 inches at Cambridge Bay would hold the C-74, but others were either dubious or cautiously preferred not to stick their necks out.

Below 5000 feet on the edges of Greenland Ice Cap, ice is very rough and crevassed.

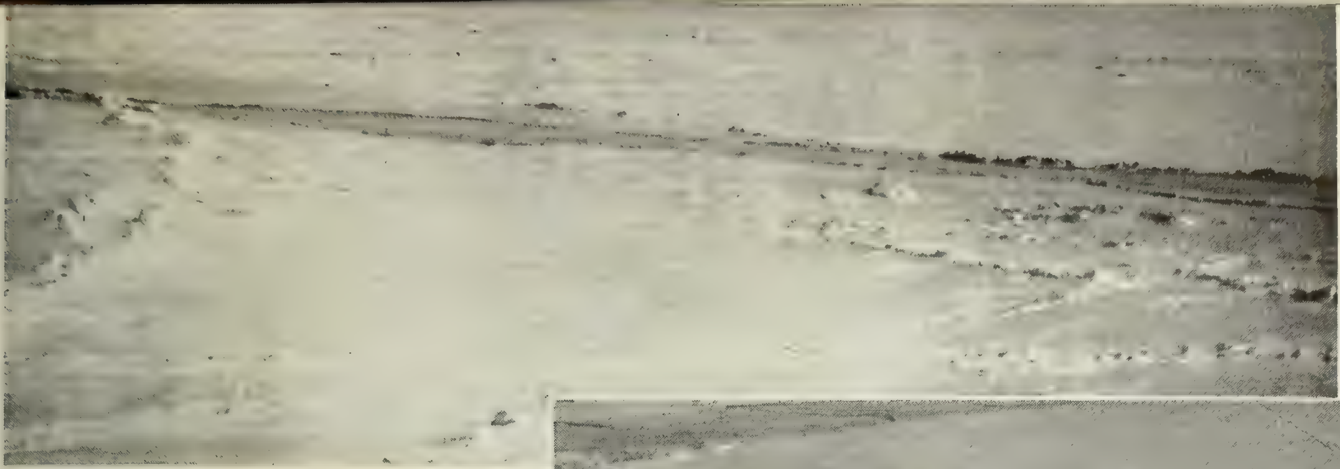
Although faced with such uncertainty, after consulting the best arctic ice authorities available to him, General Tunner made the decision to go ahead. The C-74 landed at a gross weight of 129,500 pounds without any noticeable effect upon the ice.

In 1951, the Office of Naval Research conducted a series of landings on the Arctic Ocean ice. They found that the exceptional smoothness and length of ice runways that can be found on the Arctic Ocean pack ice are such that any military land plane can be landed safely without benefit of skis or skids.

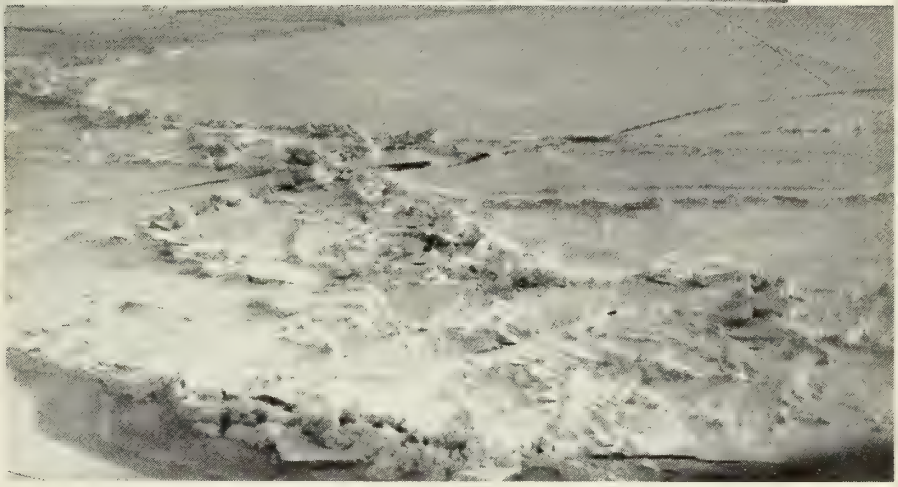
Most of the landings were made on newly frozen leads. The ice thickness of leads varied from a few inches to six feet. These pilots determined the ice thickness by observing closely the thickness of blocks of ice up-ended by pressure within the pack, by observing the snow cover and noting the color of the ice.

Before committing the aircraft to a landing, touch and go landings were made to test the ice and the validity of observations from the air. Snow cover varied from one to five inches. Drifts up to 18 inches were common, but were seen easily. Twelve success-

C-124s were used to airlift equipment to DEW Line. Over 700 landings were made at 22 different sites.



In center of photo is how a newly frozen lead would appear to you in an Arctic Ocean pack ice formation.



Of the many forms of sea ice, large floes make good landing areas. Note pressure ridges in foreground.

Ice island in Arctic Ocean during the summer. Rough sea ice, foreground, is the result of seasonal melting.

ful landings were made in 1951, and in the same year the USAF 10th Rescue Squadron also made several successful landings on Arctic Ocean ice for rescue training purposes.

In 1955, the Air Force was faced with the problem of airlifting heavy equipment to Distant Early Warning stations that form the DEW Line. These stations were located at regular intervals along the 68th parallel between the eastern Alaska boundary and the east coast of Baffin Island. The C-124 was the only aircraft capable of handling heavy equipment such as D-8 tractors weighing 25 tons each. Again, there was considerable uncertainty as to the ice thickness required to support the C-124, in this case with a landing weight of 168,000 pounds. Estimates of sea ice thickness to support this weight with an acceptable safety factor ranged from 70 to 109 inches. Headquarters USAF requested ADTIC to resolve the problem, particularly as the presence of ice 109 inches thick in the DEW Line area was very doubtful.

ADTIC organized an ice survey team of the best authorities on ice landings. This team was assigned to Tactical Air Command's Eighteenth Air Force, which had responsibility for the aircraft. Because of the lack of positive information on the bearing-strength of sea ice, the first landing of a C-124 had to be on an experimental basis.

C-124 Experimental Landing

Cambridge Bay was selected for the experimental landing because prior experience provided more general knowledge of that area than any other. Ice thickness and strength tests indicated that the ice at Cambridge Bay should hold. After three days of testing, the ice team decided to attempt the landing and it was made without incident. The C-124 grossed 168,000 pounds.

This test landing provided the basic information that was necessary to accomplish the transportation of heavy equipment for the establishment of the DEW Line. Between 10 March and 29 May 1955, over 700 landings on ice were made at 22 different sites. Some landings were made on fresh water ice, but the majority were on sea ice. All were successful.

The DEW Line aircraft was the largest in history to employ ice landing strips. Some 22 strips were established in approximately two months. The only construction equipment required was two D-4 tractors for snow removal. Imagine the tremendous and time-consuming construction program necessary to build a similar number of the conventional landing strips any place else.

Prior to 1947, experimental work had been confined to fresh water and

Surface of the Greenland Ice Cap isn't suitable for wheels-down landings. This B-17 tried it in December 1948 and is still buried beneath the snow.

sea water ice exclusively. However, since that time, experimental work has been going on to determine the suitability of land ice for air operations. Most of this work has been carried out on the Greenland Ice Cap.

Land ice has the advantage over sea or lake ice in being more permanent and thus is potentially usable throughout the year. Also, it offers excellent operational possibilities for aircraft equipped with skis or skids. Landings have been made successfully with SA-16 and SC-47 rescue aircraft at elevations up to approximately 9000 feet.

An interesting incident concerning land ice operations on the Greenland Ice Cap occurred in 1948. The crew of a C-47 began a normal instrument letdown for an approach to Narsarssuak Air Base. The first indication they had that anything was wrong was when the plane came to a sliding halt at approximately 8000 feet elevation on the Ice Cap. Passengers did not have their seat belts fastened, but no one was injured or even seriously shaken up by the smooth landing. During World War II many other aircraft made successful emergency landings on the Greenland Ice Cap without injury to personnel.

This account of some of the major ice operations illustrates that aircraft landings on ice are not new and that the use of ice for aviation offers even more possibilities. Of particular interest to the flyer is, of course, the use of ice for emergency landings. The old question of whether to ditch or to bail out is still a controversial subject which cannot be settled in general terms.

It would be senseless to establish a policy that anywhere in the Arctic above the tree line you should attempt to ditch. The Arctic is too big an area and too varied in terrain and climate to lay down specific rules for every spot where an emergency might occur. But some generalizations can be made.

Over the Ice Cap

As far as I am concerned, any time that you know you are over or close to the Greenland Ice Cap, there are approximately 637,000 square miles of emergency landing field available to you. The rule for landing on the Cap should be wheels-up. Although one or two successful wheels-down landings have been made, the danger involved in wiping out the landing gear or flipping over on your back is not worth the risk.

After you get down safely, even if you are not an ice cap survival expert, the AFM 64-5, USAF Survival Manual, will tell you what to do. And by remaining with your airplane, you have the all-important fuel for heat as well as material for shelter. That aircraft is useful.

For ski or skid aircraft, practically the entire Ice Cap above 5000 feet elevation is an ideal emergency landing field. Below 5000 feet, the Ice Cap terrain is generally crevassed or broken up by nunataks (mountains sticking out through the ice).

Over the Ocean

The question of ditching versus bailout over the Arctic Ocean is highly controversial. However, the advantages of having the survival resources of the aircraft itself cannot be underestimated. The key to making the correct decision is probably visibility. If you can let down to minimum bailout altitude it is possible, with good visibility, to get a fair idea of whether the Arctic pack has any smooth spots within reach. Wheels-up landings are the best general rules here.

The Arctic Ocean ice can be extremely rough from pressure ridges or rafted sea ice. Old sea ice (ice more than one year old) is generally rough from differential melting during the summer and drifted snow in winter. Even the smoothest of ice may have snowdrifts of sufficient depth and density to wipe out the gear.

If a smooth field or floe of ice can not be located, a frozen lead may offer landing space. Even if the ice is recently frozen and comparatively thin, still it will offer some support to the aircraft. The chances of the aircraft breaking completely through are slim, for the wings will hold it up. If you have a choice between a frozen lead and comparatively smooth, old sea ice for an emergency landing, the latter is probably the best choice, for you can be certain the old ice will hold.

In the event of a bailout, your chances of being found depend on the accuracy of your reported position. If you bail out over pack ice, your survival gear, crew or passengers are likely to become separated and each man may be faced with an individual survival problem without adequate survival equipment.

If the ground or surface is not visible from minimum bailout altitude and unless you know exactly where you are and what the surface beneath you is like, bailout is your best bet. The Greenland Ice Cap is an exception to this rule.

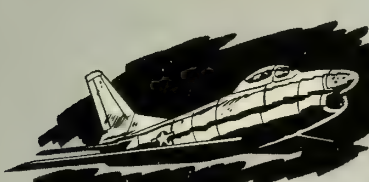
From November through May, numerous lakes and salt water bays in the Canadian Arctic offer ideal emergency landing strips. Unless you are sure that the snow cover on the ice is so shallow that it will not wipe out your landing gear, both the visibility and wheels-up landing rules should apply. You may cuss yourself after landing on your belly to find that you could have made a wheel landing and saved the plane, but at least you have the consolation of having played it safe.

As you can see, many factors go into deciding whether to bail out or crash land and each specific case has different factors to consider. But in any event there is a lot of ice in the Arctic which may save your life, if you find yourself in trouble. ●

WELL DONE

1st Lt. Donald E. Weeden

496th FIS 86th FIW Landstuhl, Germany

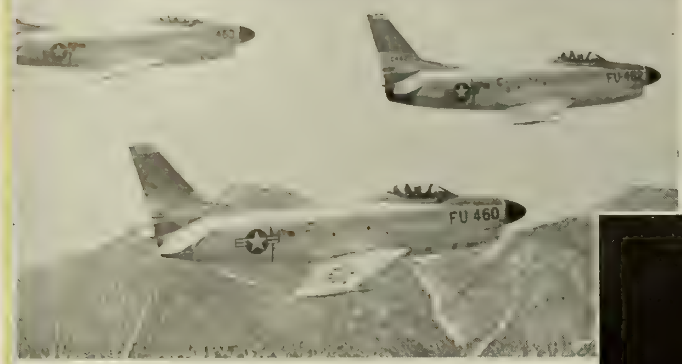


FIRST LT. DONALD E. WEEDEN ON A PRACTICE NIGHT INTERCEPT MISSION FELT A SUDDEN JOLT FOLLOWED BY SEVERE VIBRATIONS IN HIS F-86D. HE IMMEDIATELY RETARDED HIS THROTTLE AND SWITCHED TO THE EMERGENCY FUEL SYSTEM.

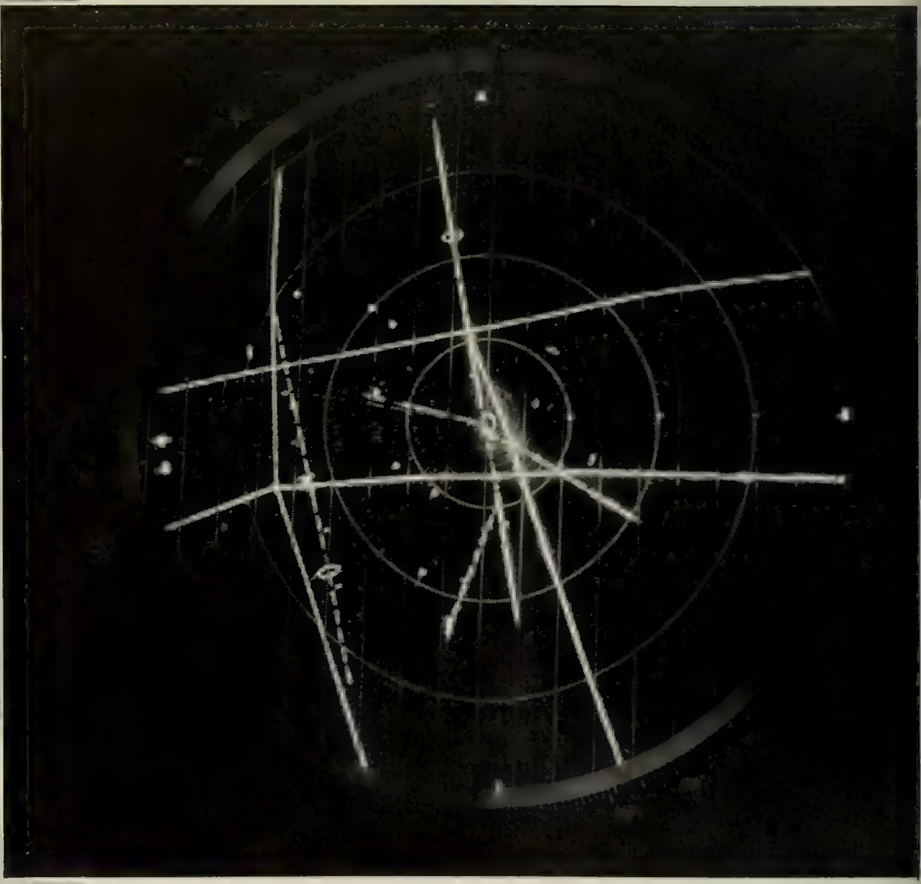
REALIZING THAT HE COULD NOT MAKE IT HOME HE ASKED GCI THE STATUS OF A NEARBY AIR FIELD. GCI ADVISED THAT ONLY TWO THIRDS OF THE RUNWAY WAS USABLE... THE OTHER THIRD WAS TORN UP AND HAD HEAVY EQUIPMENT ON IT. CONTINUING HIS GLIDE HE CAUGHT A GLIMPSE OF THE RUNWAY AND DECIDED TO ATTEMPT A LANDING.

HE ASKED GCI TO CONTACT SOMEONE TO MARK, WITH THE LIGHTS OF A MOTOR VEHICLE, WHERE THE USABLE PART OF THE RUNWAY BEGAN. COMING OVER THE FIELD IN A FLAME OUT PATTERN HE COULD SEE THE LIGHTS OF TWO VEHICLES ABOUT ONE THIRD DOWN THE RUNWAY.

RAISING THE GEAR IN ORDER TO ADJUST HIS PATTERN FOR TOUCHDOWN BEYOND THE VEHICLES HE MANEUVERED OVER THE EQUIPMENT ON THE APPROACH THEN LOWERED GEAR AND FLAPS AND LANDED ON THE 3,000 FEET OF THE USABLE RUNWAY—WITH THE DRAG CHUTE HE STOPPED THE AIRCRAFT ON THE RUNWAY!!



A flight of F-86s, a C-124 and a B-25 are illuminated clearly on a video map of RAPCON radar scope. Visible too are range legs, fan markers and homers.



Ozone Expediter

One of the answers to the traffic congestion problem is RAPCON. Here's how it does a safe job for you.

HIGH OVER AMARILLO, a flight of three F-86s streaked toward Oklahoma City. Three hundred miles east of them, a lone C-124 reported over Tulsa and gave his ETA for the Tinker range station. Simultaneously, over the Ardmore range, a B-25 out of Vance AFB asked for the weather at Tinker.

Since 0200 hours, murky clouds had skimmed incessantly over the wet runways at Tinker. Visibilities had peaked sporadically at a mile and a half. A slickered airman leaned into the cold, biting wind as he went to measure the low-hanging overcast.

Inside a large, darkened room, the eerie glow from the amber-colored radar scopes in the RAPCON Center at Tinker cast strange shadows over the faces of the controllers. Only the sound of an infrequent position report interrupted their idle chatter.

It was early in the morning and things hadn't picked up yet; still the sweep hands of the scopes searched endlessly for any moving target.

Suddenly, a red light on the en route controller's electrical panel blinked. At the same time, two other red lights flashed on. The Amarillo, Tulsa and Ardmore radio range station operators now were reporting the Tinker ETAs of an inbound flight of three F-86s, a C-124 and a B-25, respectively.

With the flashing of the lights, the Radar Approach Control Center or

RAPCON facility at Tinker AFB was in business. This facility is one of three joint USAF/CAA Radar Approach Control Centers now in operation and its job is to expedite IFR traffic in the Oklahoma City terminal control area.

This RAPCON Center is a combination Air Route Traffic Control center and Approach Control facility. It has the authority to control all air traffic in its designated area. The RAPCON Center at Tinker has direct telephone contact with Ft. Worth, St. Louis, Kansas City and Albuquerque ARTC Centers and receives essential information on inbound aircraft, including altitudes, speeds and estimated times that aircraft will arrive in the Oklahoma City area. It is not to be confused with military RAPCONs which control traffic only over their own bases.

Many know a little about RAPCON's function, but few are familiar with its physical layout. All of the equipment is housed in a rectangular room about the size of a small handball court. Two long control consoles, opposed to each other, fill the room. Seven controllers carry on their duties at these consoles.

At one console is the flight data position panel, the en route controller's panel and the supervisor's panel. Located at each position along this console are duplicate sets of the 22 available radio frequencies.

Across the aisle are located the radar scopes. In sequence are the arrival and departure controller, the feeder controller and the precision radar approach controller. They too, stand guard over the 22 frequencies.

Perhaps the most important man in the entire center is the supervisor controller. He watches the scopes and keeps track of clearances. In case of possible bottlenecks, he can issue appropriate instructions for re-routing traffic to keep things running efficiently and smoothly.

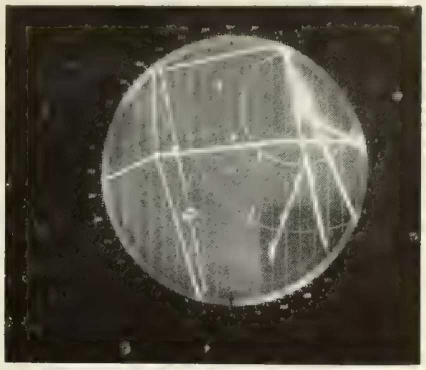
What does RAPCON mean to a pilot on the ground, to one who has awaited a long-delayed IFR clearance? It means almost immediate takeoff permission, climbout instructions, a switch to a center UHF or VHF frequency and a heading to fly which will shuttle him in between the prevailing traffic.

To a pilot flying in a congested air traffic area, RAPCON means separation without unnecessary re-routing or holding.

To a jet pilot, who is low on fuel, RAPCON means a controlled penetration letdown without delay, a turn on final and a precision approach radar run. (PAR is gradually replacing the letters GCA in radar parlance. Also, the old terminology of PPI has been discarded and ASR, Air Surveillance Radar, is now being used.)

What should you know about this facility that can accomplish this expediting of departing, en route and arriving traffic? At present, there are two categories of RAPCON installations. Many Air Force pilots are familiar with the facilities at Hamilton, Langley, Westover and Wright-Patterson Air Force Bases. They control military air traffic in their respective localities and are classified as full RAPCONs. Interim RAPCONs, scheduled to be upgraded later, are at March, Andrews, Loring, Otis, Eglin, Tyndall and Offutt Air Force Bases. There will be 53 of these installations in use in the next two years.

There are three important joint USAF/CAA full RAPCON Centers interspersed with these military facilities. These are located at MacDill, McChord and Tinker Air Force Bases. The equipment of all of the centers is owned and maintained by the Air Force and operated by AACS personnel, except for the three joint facilities. They are operated by CAA personnel. However, the Precision Radar Approach Section of the centers is operated by AACS personnel.



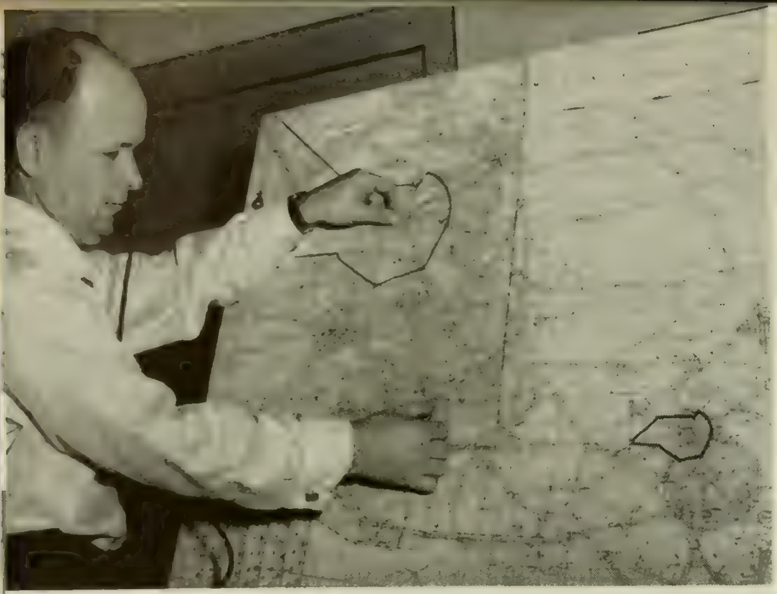
Some RAPCONs are able to direct landings at nearby airfields by offsetting scopes.

As far as a pilot is concerned, there is hardly any difference between an Air Force operated RAPCON and a joint USAF/CAA RAPCON. Essentially, both have the same radar equipment and use the same procedures and terminology.

Actual RAPCON procedures will vary slightly with localities, but a briefing on the center at Tinker will familiarize you with some of the procedures used, the layout of the radar equipment and an explanation of the controllers' positions and duties.

To highlight this innovation in air traffic control, let's follow what takes place after you file a Form 175 for an IFR flight. First, we'll use the long-established method of filing and

Controllers working at two main control consoles direct air traffic expeditiously 24 hours a day.



Follow an IFR flight plan through the Center at Tinker. Left, distances are double checked for accuracy before flight data position controller, right, begins computer check on ETE and enters it on progress strip.

being cleared by an ARTC center over leased telephone lines and then we'll file, using RAPCON.

You are flying from Tinker to Wright-Patterson AFB. The dispatcher hands you the carbon copy of the 175 and you saunter out to your aircraft. Meanwhile, this dispatcher picks up a telephone and calls the en route controller at Ft. Worth Center on a leased line and the approach controller at Will Rogers Airport. Also, Tinker tower is notified of your IFR flight.

While you are taxiing out to takeoff position, Ft. Worth is clearing your flight plan through the St. Louis center, all by telephone. Also, within his own center, the en route controller coordinates your flight plan and the approach controller must determine your takeoff instructions, climbout instructions and first compulsory reporting point.

If you are fortunate, in a short time the flight plan that you submitted comes back over the telephone circuit approved. However, due to other traffic or departure clearances at near-by bases, you may have a long delay, there on the ground.

The phrase "There will be an indefinite delay" from a tower operator about this time is enough to start the ulcer factory in your stomach to working overtime.

Now for a RAPCON treatment. The dispatcher wishes you a "Bon Voyage." As you stroll out of operations, he picks up a telephone and calls your flight plan to the RAPCON Center. Also, Tinker tower is read in on the act. The tower operator calls the center when you ask for your taxi instructions.

In the RAPCON Center, when your flight plan is received by the flight data position controller, he enters the necessary information on a flight data strip. Sitting beside him is the departure controller. Next to the departure controller, along the electrical panel console, is the en route controller. Immediately they discuss and clear your flight plan within the Oklahoma City and St. Louis areas.

By the time you have taxied out to takeoff position, your clearance is ready. You call Tinker tower and he requests that you channel to one of the 22 UHF/VHF frequencies guarded by the center. Since the radar sweep hands pick up any moving target in a 50-mile radius, up to 20,000 feet, around the Oklahoma City area, they can approve your flight plan and issue climbout instructions.

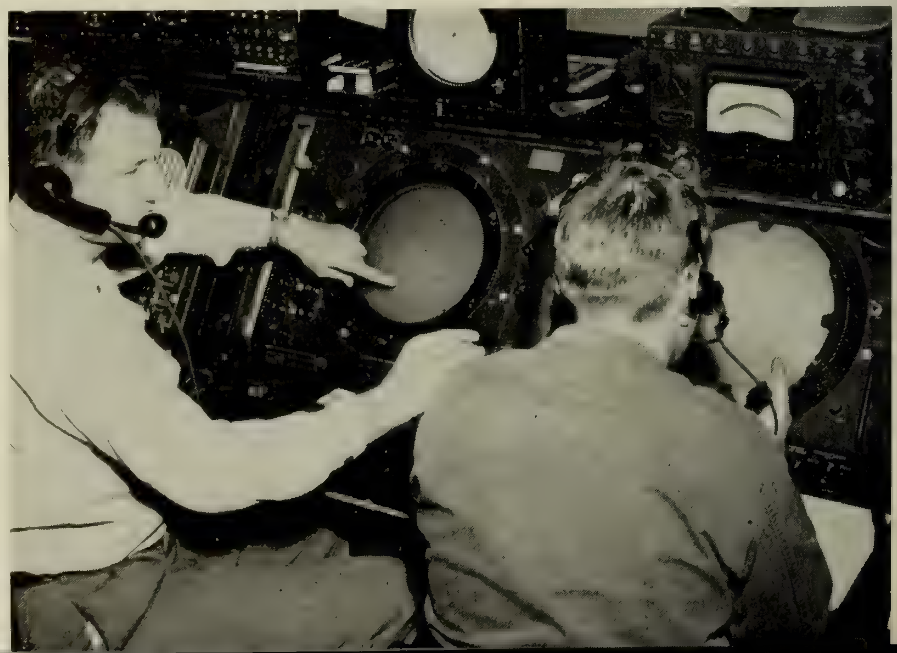
Having all pertinent traffic "painted" on his scope as aircraft fly into the area, the departure controller has you climb out on a specific heading, and then turn to another predetermined heading at a given altitude. Next, without hesitation, he fits you into the prevailing traffic at your altitude.

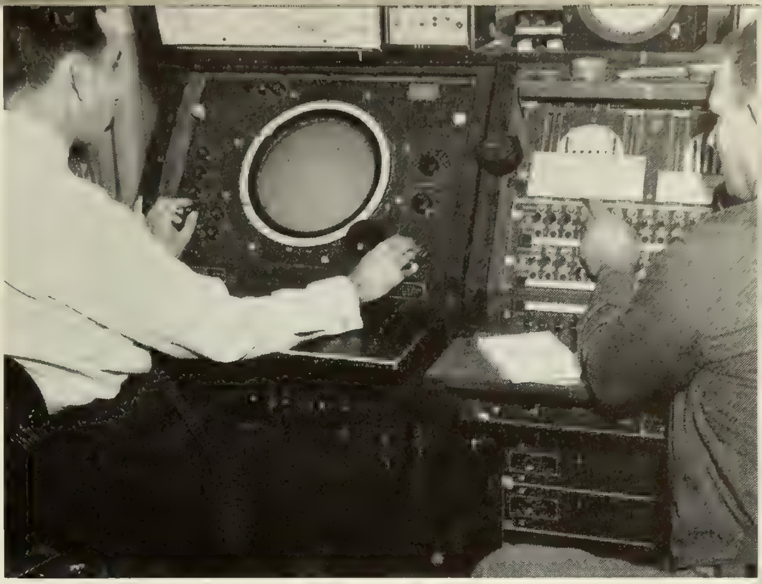
No delays using telephones. Delay with incoming traffic is minimized. No sweat about somebody reporting where they think they are. They're either there or they aren't. It usually happens that just about the time a pilot is ready to pick up the mike to tell the center he is over a fix, the controller confirms it beforehand. All pertinent traffic in the area is under surveillance. That's why RAPCON is so efficient at expediting air traffic.

When you're en route, it's the same smooth story. Remember the inbound F-86s, the C-124 and the B-25, who were converging on Tinker? By following them in, you can see how RAPCON handles three different types of aircraft at the same time, without a hitch.

Once notified in what direction and approximately at what time traffic will enter their area, the controllers bend to their work over the scopes. Every little blip is pinpointed, con-

Feeder controller, left, turns over aircraft to the precision approach radar operator for landing.





From flight data position, clearance is given to pilot over one of 22 radio frequency channels available.
Operator gives vector headings to departing aircraft as coordinator keeps tab on other planes in area.

firmed and followed with intense and precise accuracy.

Knowing that the F-86s probably will want to penetrate at 20,000 feet, the center contacts any slower moving traffic that might interfere with a penetration letdown at Tinker. These aircraft are conveniently vectored to another heading or altitude. This can be done with several aircraft at the same time. By having the F-86s at 20,000 feet, there is no delay over Tinker for the start of their penetration.

Meanwhile, from the other side of the scope, the C-124 looms into sight. When 25 miles out, the pilot is given an off-airways heading to fly and permission to let down to minimum altitude. His target on the scope moves slowly away from the traffic. It is easy to keep track of him because every time the sweep hand makes a complete circle, it shows the aircraft's exact position clearly and distinctly.

Now the B-25 becomes a blip on the bottom of the scope and the arrival controller sets his forefinger on the face of the dial to keep this new track under constant surveillance.

"Oklahoma City Center, Air Force Jet 52368 in procedure turn."

"Roger, 52368, continue your letdown. We have you in radar contact. Report completion of procedure turn inbound."

Sitting beside the feeder controller, who has the F-86s on his scope when the penetration begins, is the AACS precision approach radar technician. The feeder controller taps him on the shoulder to indicate that he is turning the F-86s over to him. Acknowledging by a nod of his head, the sergeant speeds up his azimuth and altitude sweeps on the scopes.

"Oklahoma City Center, Air Force Jet 52368, completing procedure turn, over."

"Roger, 52368, this is your final controller. How do you read?"

"Five by five."

The sharp, incisive voice of the technician begins the delicate task of bringing the three F-86s down the glide path. Within a minute or so, the F-86s break out of the overcast and land without a hitch.

The C-124, meanwhile, has been vectored onto his base leg.

"Air Force 19111, we have you seven miles northeast of the Tinker range. Continue your heading of 250 degrees. This is your base leg. Your gear should be down and locked."

"Roger, Oklahoma City Center, this is 19111."

In the interim, the B-25 contacts Oklahoma City Center and without any delay, is worked into the letdown sequence and follows the C-124 down the groove and over the runway for a landing.

Previous to the implementation of RAPCON, two, and possibly all three aircraft would have had to execute some type of holding pattern. Telephone conversations with different control agencies, interphone discussions with GCA or possibly departing IFR clearances could have slowed the orderly flow of traffic. RAPCON, by the use of its radar eyes, has eliminated these delays.

One operator can handle safely three aircraft in the landing pattern at any time. Since there are three of these independently controlled scopes in the center, nine aircraft can be directed safely within the area. Also, it is possible by off-centering the scopes to direct takeoffs and landings at Will Rogers Field, 12 miles away.

Varying slightly from a joint USAF/CAA facility are the military RAPCONs. They deal primarily with military traffic around their area.

Such is the case at March AFB. Through an agreement with the Los Angeles ARTC, the March RAPCON controls all IFR departures and approaches to March and Norton Air Force Bases.

Placed into operation a year ago, this RAPCON has controlled jet bomber missions with such precision that takeoffs with only one minute separation in minimum weather conditions are common practice.

By following precise departure plans the technicians follow the B-47s relentlessly on their scopes as the big swept-wing birds take off and climb out on predetermined headings. If one wanders too far from its planned route, a call from RAPCON alerts the pilot's attention to this fact.

Slower aircraft are controlled in their climb in race track patterns over different fixes to eliminate takeoff delays once a mission has been started.

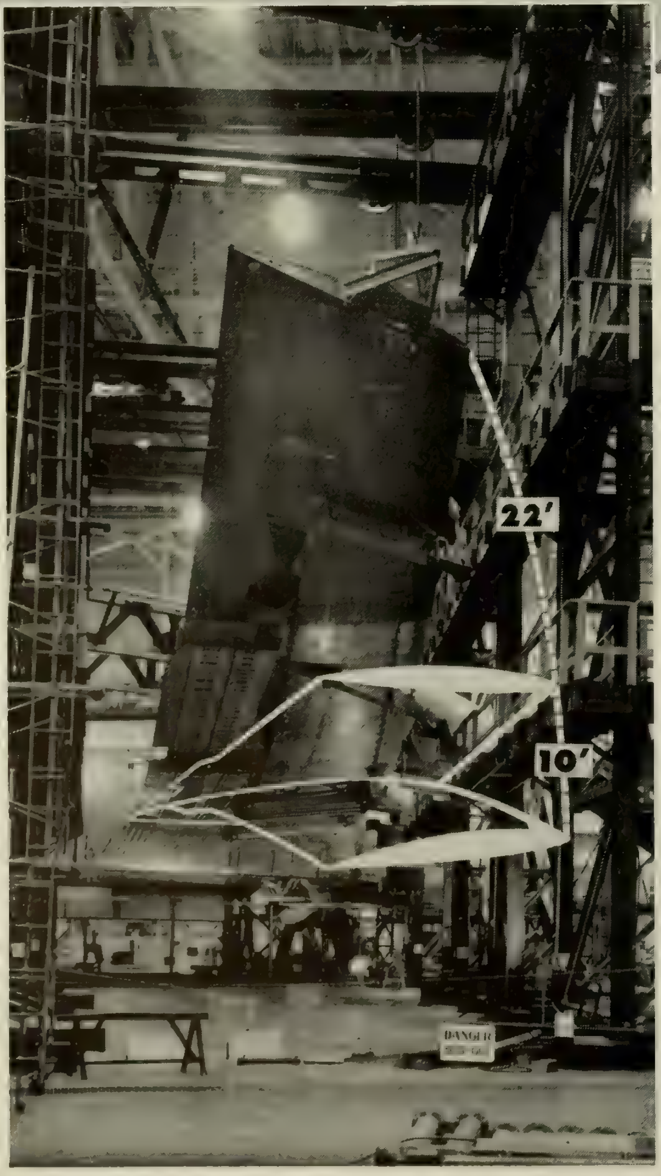
Handling a gaggle of B-47s inbound consists merely of following established approach plans. Once the RAPCON has contact with them over a designated radio fix, it is a matter of bringing them "down the chute" with five-minute separations.

In case of radar failure, all an operator has to do is to call the ARTC center and standard separation procedures will go into effect immediately to issue clearance.

Anyway you look at it, RAPCON is here to stay. It's one of the answers to the traffic congestion problem and it can do the job safely. ●

Keep Current

NEWS AND VIEWS



Fire Simulator—Simulators have proved themselves successful in training pilots and now ARDC has come out with a new aid in fire fighting.

Modeled after four operational aircraft, the B-36, B-50, B-45 and the F-86, these trainers are constructed of steel plate and rest on beams supported by solid concrete foundations.

The steel trainers can easily withstand the extreme temperatures encountered when standard aircraft gasoline or jet fuel is burned in open air. These temperatures can reach over 2000°F. for short periods.

To provide realism, all escape hatches, gun positions, fuel lines and fuel tanks are built into each trainer. The points at which the fire fighting crew must make forcible entry into the aircraft are covered by replaceable sheet aluminum.

In a typical training run, 200 to 1000 gallons of condemned high octane aviation or jet fuel are used. The fuel is spilled on the ground around the trainer and directed by hand valves within the trainer so that the fire pattern closely resembles an actual crash fire.

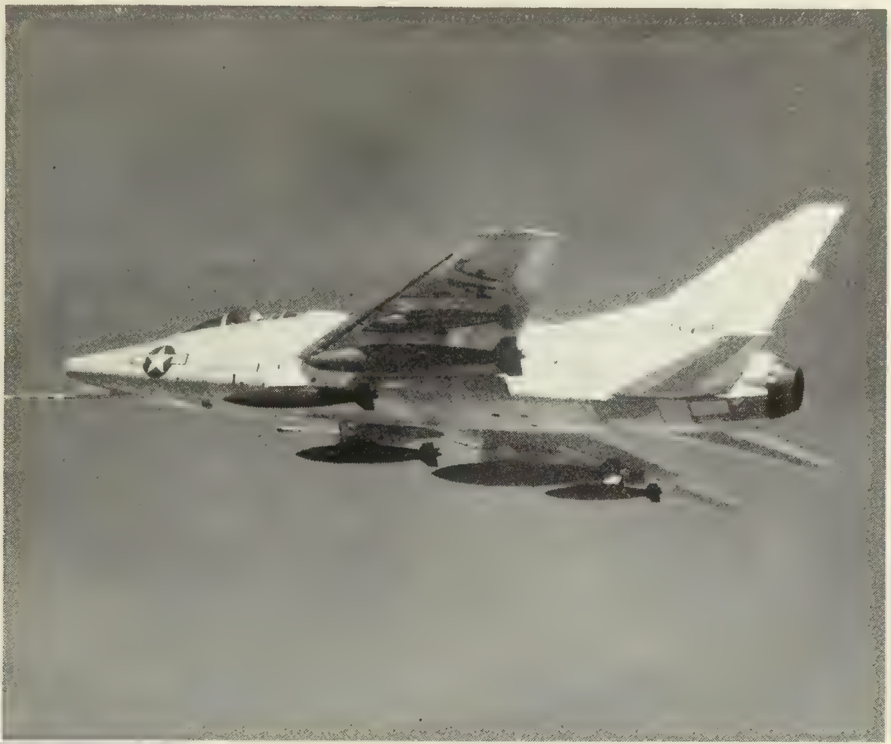
In addition, a variety of fire conditions, such as might result from ruptured fuel lines, can be duplicated by control valves. This training method is much superior and provides more realism than the previous system in which derelict aircraft were used. ●

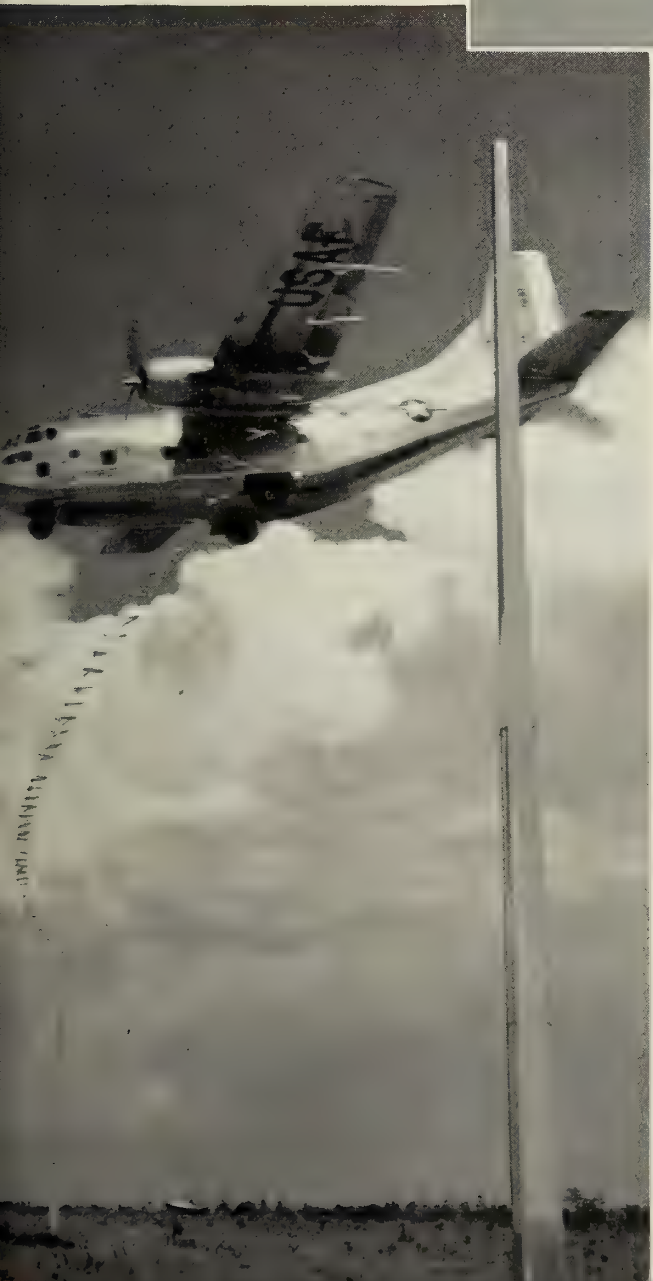
Left, this illustration depicts the extremes of upward and downward deflection to which the B-52 wing was subjected in load tests during the wing-bending phase of the static test program. Deflection was 22 feet above and 10 feet below normal unloaded position, far exceeding any which might be encountered by the plane in severe weather.

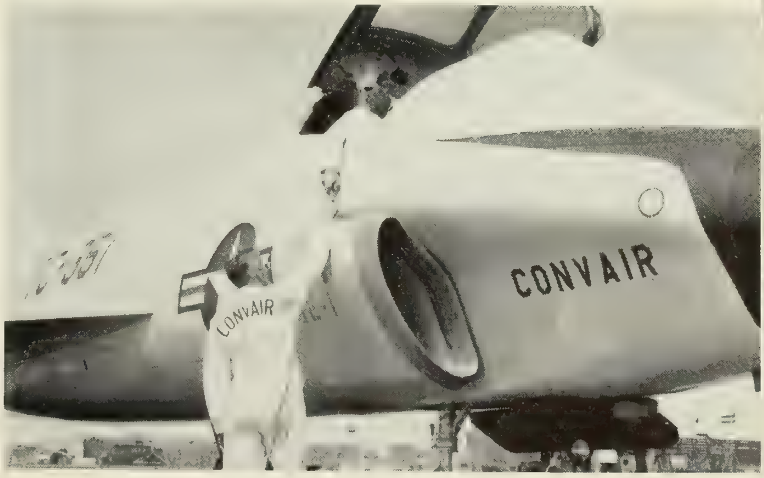
Right, the long range F-100C has bomber as well as fighter capabilities. Suspended under its wings are 500, 1000, 2000-pound bombs.

Left, with two large T-49 turbo-prop engines replacing the four jet engines in the inboard pod position, an XB-47D leaps into the air.

Below, landing downwind, this C-123 shaves a 50-foot barrier marker as USAF operational suitability tests are started at Eglin AFB.







Protective paper still covers the canopy and windshield of the first TF-102A to come off the line. This combat proficiency trainer has a wider nose section than the F-102A to allow for side-by-side cockpit.

What are the Odds?

The idea for this article originated when the author was reviewing past accidents in an attempt to determine where future efforts should be concentrated for the most effective accident prevention. He reviewed the last one hundred T-33 accidents in the Flying Training Air Force, and came up with a pretty good preview of what to expect in the future.

While the figures concern only T-33 accidents in FTAF, the article is presented in such a way that it is applicable to any type of aircraft in the Air Force. Read it and do a little soul-searching . . . if you are a believer in the law of averages and in cold facts, you may find your future discussed below.

Major Clyde K. Voss, Hqs FTAF, Waco, Texas

I DON'T KNOW the odds against your having an accident in the near future, but I can quote you some rather accurate figures concerning which category you will fall into if you do prang your T-Bird.

Odds Are 100 to 21

The chances are 21 out of 100 that if you have an accident, you will undershoot or make a hard landing. So, unless you deliberately analyze each of your patterns and landings, and then decide to go around when things aren't just right, you are a candidate for this group.

Odds Are 100 to 16

Sixteen more of these one hundred T-33 accidents also will be on or near the runway. To be more specific, 16 will either overshoot or run off the runway for various and sundry reasons, such as tires blowing out by over braking to avoid the runway barriers. We all can avoid the statistics here if we use the barrier at times like these rather than try to avoid it. Two pilots have hit the stanchions just to avoid the cable! That's skill?

Odds Are 100 to 12

Twelve hot rocks out of that 100 will be tooling along when suddenly they learn something that you can learn right now; i.e., it won't run without fuel. A couple of these steaming stones just won't preflight the aircraft properly (tiptank caps loose). Another couple won't know that with electrical failure, the main wing and leading edge fuel is not available. The others will simply fail to turn the switches on (most likely while flying in formation).

Odds Are 100 to 8

Eight of these 100 pilots won't look around enough. You guessed it—midair collisions! Do you look around enough just because you haven't hit someone yet? Of course not. To look around enough, you must be constantly alert and deliberately search the sky, not just sleepily gaze out into it. There are probably 100 aircraft in the air around you each flying period. How many can you see at any one time? One or two? That leaves you just about 98 to look for.

Odds Are 100 to 7

Seven of the 100 will leave mobile controllers (smoking flare guns in hand) slack jawed as they "slide 'em in." What else? Gear up landings, and these are all pilot error. Two of these heroes will pull their pesky gear up prematurely while dreaming of a double Immelmann off the deck, no doubt. Strangely enough, these deals that leave the controller slack jawed, seldom have the same effect on the old man.

Odds Are 100 to 7

Sad and unnecessary though it may be, seven of the 100 will stall or spin in. Four of these accidents will happen in the pattern. If you prefer to avoid being in this category, know your spin recovery so you can do it automatically, know your airspeed at all times, recognize a high speed or accelerated stall and when you overshoot final, take it around.

Odds Are 100 to 7

No one knows why, but another seven of these 100 pilots will violate one or more regulations or perform some kind of unauthorized maneuvers. The majority of these accidents will result in fatal injuries. (The primary cause of two of these accidents will be listed as "Undetermined." We will suspect hypoxia or hyper-ventilation, but it's hard to prove. You won't be one of these if you follow the oxygen procedures taught in the training program.) Most common among these will be overstressing the aircraft, probably by pilots who do not know that an aircraft limited at 6G can be overstressed at 4.1G, if those G are pulled in a rolling maneuver. Buzzing is getting out of style fast these days, but there's always someone who hasn't heard the word. Not too long ago, civilians stood in awe as "Dashing Dan" zoomed past in his flying machine. Now-a-days the base commander's phone is ringing before our hero even realizes he's flown through the power lines.

Odds Are 100 to 5

Five of the 100 accidents will be forced landings due to engine failure. None will be fatal, but several could be prevented altogether. Maintenance personnel play the big part here, of course, but they must depend to a great extent on the pilot, particularly on his knowing and observing the engine limitations. Your write-ups are the only clue to how things went on the flight, so observe closely and write up accurately and completely. Finally, know your airstart and forced landing procedures and you probably won't get hurt.

Odds Are 100 to 4

Four accidents will result from some other type of materiel failure. Half of these will again be brought on by stresses which pilots can reduce. Resist the urge to operate at the maximum and treat your aircraft at least as respectfully as you do your automobile. It would take every cent a captain makes for over 13 years to pay for one T-33. If your car cost that much, how careful would you be? All Uncle Sam asks is that you use your best judgment.

Odds Are 100 to 3

Three accidents will result from maintenance error, though again the pilot possibly can eliminate or reduce this number. For example, one of these will be reversed control cables. It's "Maintenance Error" all right, but notice the pilot's checklist where it says "Before Starting Engine," item #2 "Flight Controls — free and proper movements." The obvious point is: Use your checklist. Approximately seven of the accidents referred to elsewhere in this summary can be avoided by a proper preflight.

Odds Are 100 to 3

Three accidents will result from becoming lost. Actually, becoming lost is not too uncommon nor too serious, normally. However, these three persons will not make use of the multimillion dollar communications and direction finding network provided for them until they are too low on fuel to get home. Know and use the "lost procedures" when you first need them, not after it's too late. If you are lost and no one knows it, you'll never get any help.

Odds Are 100 to 2

An untold number of pilots will inadvertently jettison their canopies. Two accidents will result. All will be pilot error—accident or not.

Odds Are 100 to 1

Only one T-33 will land gear up because of mechanical malfunction of the landing gear. This is a good indication of the reliability of this aircraft, for during this period of time, almost one million accident-free landings will be made.

Odds Are 100 to 1

One accident will be caused by the aircraft hitting some unmarked obstruction. Look around, and see what you look at. Report obstructions.

Odds Are 100 to 3

Last, but not least, three ingenious individuals will either think of a new way to have an accident or will choose one of a hundred other "approved" methods. One old favorite is to stopcock it in flight to practice airstarts, only to find that it won't start. Possibly someone will even find something to taxi into.

By taking just a couple of minutes to analyze the situation you can deliberately avoid the bad spots. You naturally use more caution walking across a busy street than you do on the sidewalk, so it should be natural to use your utmost skill and judgment when flying in the "danger zone," so to speak. For example, we can see that:

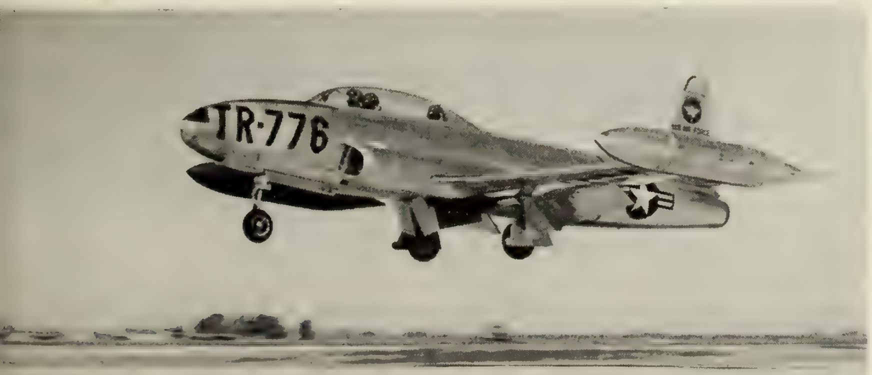
- About 45 per cent of the T-33 "danger zone" is on the runway, and mostly during the landing phase. Obviously, only your best is the minimum required at that time.

Twelve out of every hundred accidents involving jets result from fuel starvation.

- About 20 per cent of the accident potential will be the result of the pilot's inattention to his business in flight and preflight. (Fuel, midair collisions, flying into other objects and so forth.) What better advice than the old standby, "look around?"
- About 15 per cent of these accidents will require faultless use of emergency procedures. Get out your Dash One and make certain that you know all of the emergency procedures perfectly.
- The seven per cent attributed to violations and other such things is simply unnecessary.
- Five per cent is attributable to maintenance and materiel.
- Approximately eight per cent of the potential is from ignorance about equipment and normal operating procedures. Here's where the little things really count. Radio and air discipline, attention to briefings, good health, proper foods, plenty of sleep and all the little items that go to make a sharp pilot, pay off here. Check the odds, take your choice and then bet your life. ●

Undershoots or hard landings will account for twenty-one out of every hundred accidents.

During the landing phase, you must be especially sharp for this is called the "danger zone."



George Turns Tige

John Harper, Lear, Inc.

AUTOPILOTS HAVE BEEN in aircraft for a long time. The bomber and cargo boys have come to regard them almost as an extra pilot; especially on long missions. But what about the auto-pilot installation in fighter type aircraft? Are they worth while or not?

I thought of this when I received a report last month that a fighter-interceptor squadron at Chitose Air Base has joined the growing number of ADC squadrons in requiring that the autopilots be in commission on all alert aircraft. The order originated with the operations officer. He proved to the satisfaction of virtually everyone at the base that the climbout can be made faster and that a higher speed can be maintained at altitude by use of the autopilot.

Still another recent report shows that operations officers are not alone in their enthusiasm for this equipment. The pilot who was high scorer for CADF in the recent interdivisional Rocket Meet at Yuma, and who tied for high score of the meet with 5000 points out of a possible 6000, reported that he "always used the autopilot on his F-86D, at least until getting a lock-on."

Such reports are becoming increasingly common, and these particular remarks sum up the points where this bundle of animated hardware can help you most—In pilot fatigue relief, in consistently producing maximum aircraft performance and in search and tracking precision.

For various reasons, however, these points are not yet universally accepted among fighter pilots. Many of them feel that the autopilot deprives them of the privilege of flying the airplane. Some claim they can fly a mission better manually and a few are concerned unduly about the probability and consequence of autopilot component failure.

In the early days, when autopilots had no maneuvering capabilities and were quite large and heavy, they were used only in transports and bombers. Fighter aircraft had little need for these autopilots and could ill afford the large weight penalty. In World War II, when fighters were called upon to perform long-range escort missions, autopilots were installed in some of these escort aircraft to relieve the pilot during the cruising portion of the long flight. The concept was to deliver him over the target without undue fatigue, in good physical condition to defend the bombers against enemy fighters.

Following WW II, an autopilot featuring maneuverability was introduced and definite strides were made toward reducing size and weight. As the all-weather interceptor concept became more clearly defined, the requirement for a maneuvering autopilot was established for aircraft in this class, particularly those models designed for a single crewmember. The Civil Aeronautics Administration reports that in 1954, 134,000 instrument approaches were made by military aircraft; a 44 per cent increase over 1953. Probably a good portion of those involving fighter aircraft were made with assistance from the autopilot and approach coupler. Present-day autopilots are well suited for this type operation.

Today, there are autopilots capable of precisely controlling an aircraft through complicated weapon delivery maneuvers and the carefully planned recovery methods associated with them. These systems are expected to meet the requirements of the one-man strategic bomber.

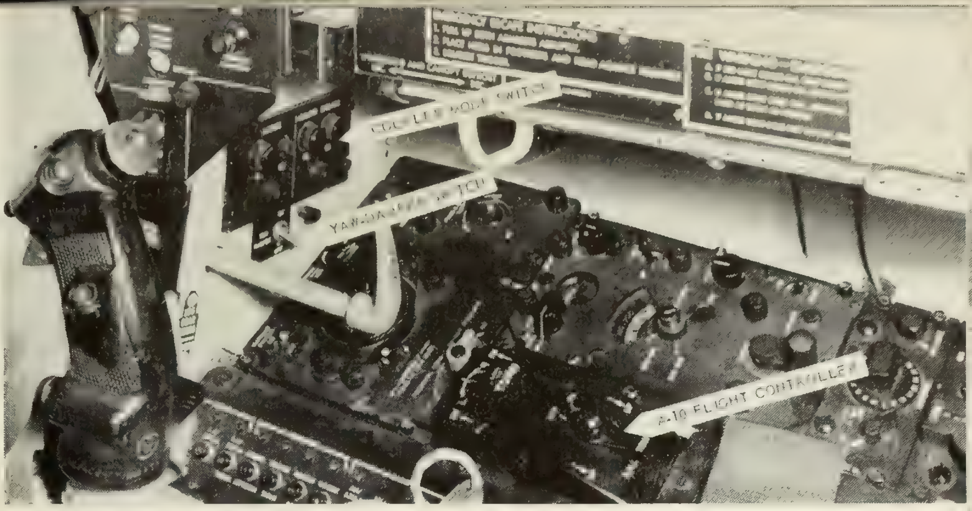
Let's face it, gents, the autopilot and its little brother, the damper, are here to stay. Not even day fighters are immune to the black box plague. Supersonic performance, and the aerodynamic characteristics which make it possible, have compromised stability and control to the point where some type artificial stabilization is required, namely, damping systems or stability augmentors.

In this article, we are discussing the Lear F-5 autopilot, as installed in the F-86D, and the things it is intended to do for you . . . the pilot, navigator, radarman, gunner and radioman all rolled into one. However, most of the things we say will be applicable to any maneuvering autopilot.

To illustrate the servo loop principle, a simplified block diagram of the pitch control system is shown in Figure 1. The outer loop carries signals from the gyro for corrective positioning of the control surface, and these error signals disappear when the gyro senses that the airplane's attitude has been appropriately changed. The inner loop stabilizes control surface position through continuous monitoring by position-indicating devices known as follow-ups. (Auxiliary signals, as from the controller and approach coupler, merely cancel some of the gyro signal before it gets to the amplifier and thereby change the system zero point.)

These two controls form the simple basis for practically all the old "pilot relief" autopilots, and are used to

This little black box is the F-5 controller.



Above, control box, as installed in F-86D. Below, pilot demonstrates fingertip control.

stabilize the airplane at a selected attitude of flight. By adding a controller, it is possible to maneuver the airplane to an extent limited by the range of the controller. The old manual synchronizing or needle matching has been eliminated by automatic synchronizing, and automatic stabilizer trim is provided during autopilot operation. These features preclude any changes in pitch attitude when engaging or disengaging. Neither roll synchronizing nor trim is provided in the present system.

Besides the inherent safety aspect of the automatic trim and synchronizing systems, each servo is fitted with a slip clutch. All servo torques must be transmitted to the aircraft controls through these clutches, which are set to keep the maximum G, or yaw angle, within the safe range during any conceivable autopilot malfunction. The slip clutches are designed to permit the pilot to overpower the autopilot if necessary. These safety factors practically eliminate any concern over what may happen in case of a malfunction close to the ground during the final approach as long as the autopilot is monitored closely, with one hand on the stick.

In short, the equipment seems complicated only if you try to look at all of its functions at once. Separately, each function is as simple as the instinctive and proportional reaction of your hand on the stick when you read an attitude or azimuth change on your instrument panel.

Now let's go through an ordinary interceptor scramble flown under instrument conditions. We'll see what you, the pilot, are required to do and how your autopilot cannot only help you with many operational details but even increase your aircraft's range and endurance. This, of course, increases the margin of safety on a tactical mission.

Less than five minutes from the moment the scramble order is received, you are raising the gear handle and flipping on the autopilot. At 300 feet, on instruments, the autopilot handles the mechanics of flying the airplane while you manage the operation with a cool head.

"Quinella, this is Lootless four-one, airborne at 23, request vector."

"Lootless four-one, this is Quinella. Turn left, vector 240, angels 35. . . ."

While acknowledging this transmission you set the degree of left bank that you want with the autopilot turn knob and adjust the pitch trim wheels to obtain the Mach number for best climb. As the aircraft heading approaches 240 degrees, the turn knob is rotated smoothly back to detent and pitch attitude is readjusted to maintain climbing Mach number. Slight pitch attitude adjustments are required, as Mach numbers tend to increase with altitude, and heading changes are made smoothly and accurately by the use of the turn knob in response to GCI control.

You are now at "Angels 35," painting the bogey on the TV set while the autopilot is holding the assigned GCI vector and the selected pitch attitude, both within one degree.

"Lootless four one, this is Quinella, bogey at eleven o'clock, 15 miles—PUNCH!"

"This is Lootless four-one, JUDY!"

You manipulate the radar hand control, release it and you are locked on. The target dot may now be followed by the use of the autopilot turn knob and pitch command wheels. When and if the point is reached where the required maneuvering rates exceed those available on autopilot control, you merely disengage and complete the run manually.

Following the run, and still on autopilot, you set up the vector and altitude assigned by GCI for your return to base. Since the inbound ILS course is within 90 degrees of your heading back to base, you request a straight-in automatic ILS approach from GCI. The necessary preparation for this approach requires only checking that your ILS radio receiver is ON and tuned to the correct ILS frequency.

Now GCI control has maneuvered you into a position 30 miles out on the ILS beam at 7000 feet, 300 knots and on the inbound ILS heading. At this point the localizer needle will be somewhere near the center and the glide path needle near the top of the ID-249. You engage the approach coupler localizer control and maintain 7000 feet until the glide path needle drops to the center. At this point you engage glide path, decrease engine RPM and extend dive brakes to gradually reduce speed during the descent on glide path control. The aircraft will nose over automatically and after two or three oscillations settle down on the glide path.

At 2000 feet above the terrain, holding about 175 knots, you extend landing gear and flaps, close the speed brakes and set your engine at 81 to 83 per cent to stabilize at 150 knots on the glide path. You are given landing clearance by the tower at the outer marker, so you just sit there in your office. Remember to carefully monitor the approach coupler operation on your instruments and be ready to take over manually at any time. Also, the automatic coupler always will attempt to keep the aircraft on the glide path. If you fail to keep enough power on, conceivably the coupler could stall the aircraft out.

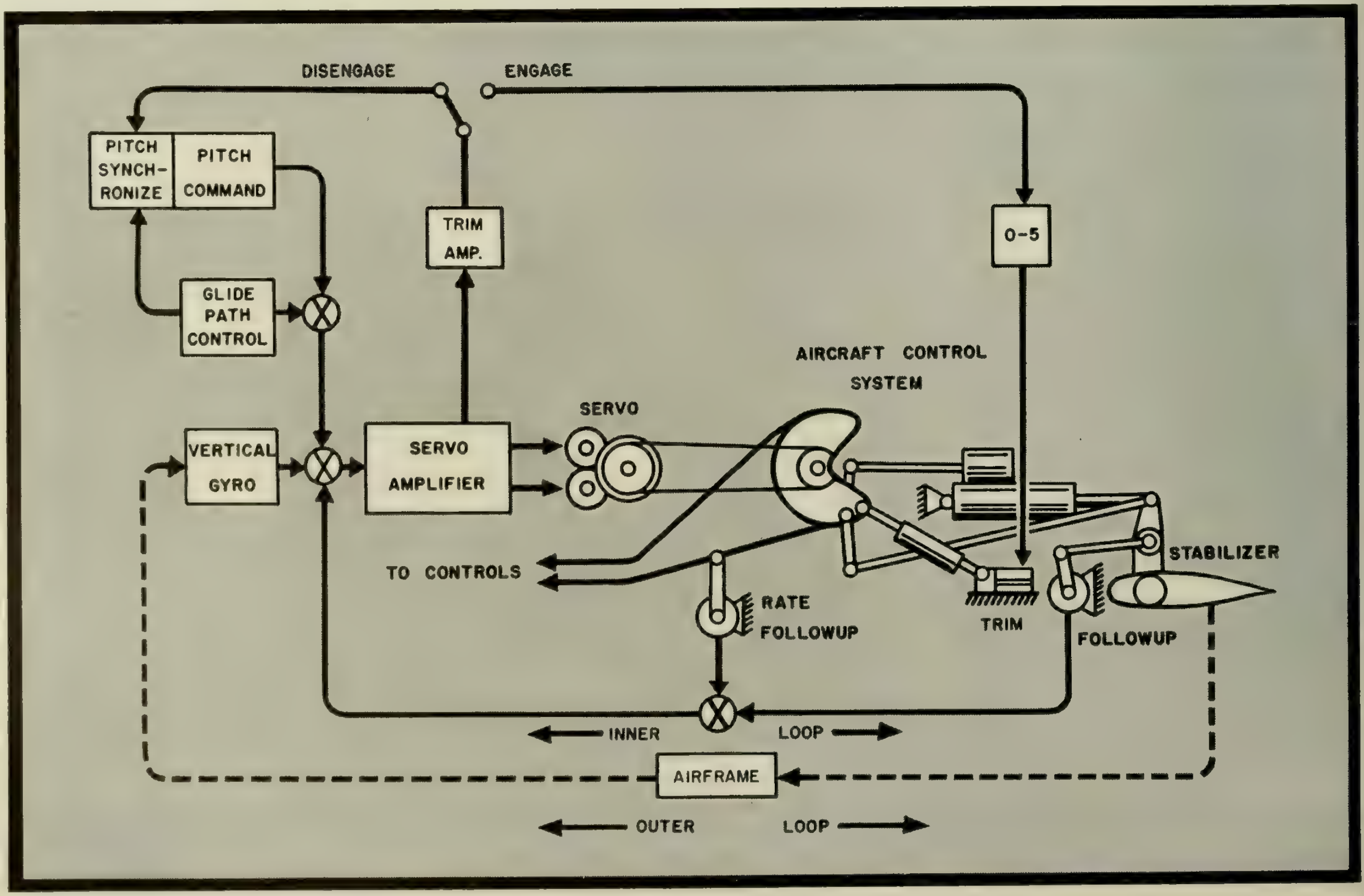
You break out of the clouds over the middle marker at 200 feet and with the runway in sight you take over manually, extend speed brakes and land.

Sounds easy, doesn't it? Well, it should be just that easy, *if* you have practiced this operation enough to know how to handle the autopilot and to know exactly what to expect of it and *if* your autopilots are receiving proper maintenance.

The F-5, or any autopilot, has natural limitations which are not necessarily the same as yours or the airplane's. For example, the maximum bank angle attainable with the turn knob is between 45 and 50 degrees. This is plenty for most applications, such as IFR penetration, GCI climbout and search, but may not be enough to follow the E-4 steering dot through phase 3 unless the run is set up perfectly to begin with. The loss of altitude during turns can be controlled easily by the pitch knob after a few hours flying on autopilot control. Autopilot technique must be developed by practice just as manual piloting technique is developed.

The F-86D simulator is quite useful in this regard if its shortcomings are known and their effects carefully considered. These simulators lack automatic stabilizer trim on autopilot, and although pitch attitude is synchronized, stick position is not. This results in a stick jump on engagement and disengagement, but the autopilot will hold the engagement attitude and the airplane will return to it after disengagement, in contrast to normal autopilot operation.

Fig. 1. This block diagram shows how the pitch control system works.



It is impossible to overpower the autopilot in the simulator since the manual control system is disconnected entirely during autopilot flight. Responses to pitch command and roll trim vary excessively over the speed range and do not correspond to the airplane installation. In spite of these discrepancies, the simulator will help develop individual autopilot technique and procedures.

Good autopilot maintenance starts with the pilot, just as airframe or engine maintenance does. The pilot must know how the autopilot should operate and then must write up complete and accurate Form 1 discrepancies. "Autopilot Inoperative" should never be used unless it is completely inoperative and cannot even be engaged. When autopilot discrepancies are encountered during flight, a little bit of testing should be done, time permitting, to get as much information as possible for maintenance.

The maintenance department must necessarily provide for periodic checking of the autopilot system, preferably during the regular checks. Calibration settings and follow-up outputs are the very minimum items that should be checked during every minor inspection, and a complete system check and set-up should be accomplished during every major inspection. This system minimizes the number of discrepancies between inspections and assures improved autopilot operation overall.

To accomplish this, both pilots and maintenance personnel must have a basic technical knowledge of the system and be thoroughly familiar with its operation in the air and on the ground. Autopilot technical representatives are assigned to most F-86D bases and two F-86D qualified pilots are employed by the manufacturer to visit all bases in the U. S. on a rotating basis. All of these personnel have been given thorough training on the theory, maintenance and operation of the F-5 autopilot, and the two pilots are well acquainted with its utility in the F-86D aircraft. The tech reps are there not only to assist maintenance personnel but to help pilots become familiar with the theory and operation of the F-5. If you are in doubt about something in the autopilot, ask your tech rep. If he doesn't know, he'll certainly find out.

What changes and improvements can be expected in future autopilots? General improvements in autopilot response and control accuracy have been made in the last few years and can be seen in the autopilots flying in prototype aircraft and in modifications to existing autopilots. In addition, several features have been developed which will extend automatic flight control to functions requiring accuracies which cannot be maintained by flying manually.

The author flew fighter aircraft during WW II. Leaving the service in 1945, he graduated from the University of Michigan in 1948. He then worked for the National Advisory Committee for Aeronautics for four and a half years. Assigned by Lear, Inc., as project engineer and test pilot for the F-5 autopilot, Harper is well qualified to write on this subject.

Altitude Control—Different methods of automatic altitude control have been in use for a number of years on a variety of aircraft, but so far the only indication of automatic altitude in F-86D aircraft has been the button on the approach coupler control panel. Experimental installations have been flown in the F-86D and a modification is now planned which will include provision for altitude control. The altitude control signal is introduced into the system in the same manner as is glide path control.

Stick Steering—This feature is available for aircraft now in the prototype stage and is being retrofitted to some old systems. This, of course, provides for control of pitch and roll through autopilot by use of the airplane's primary control column and is considered a necessity in systems intended to be flown at high speed at very low altitude.

Automatic Weapon Delivery — Weapon delivery techniques presently being developed require control accuracies which cannot be achieved consistently by the pilot. The automatic fire control system now installed in F-86D aircraft is the forerunner of similar systems which will take a bigger slice of the complete interceptor mission, possibly on a programmed basis and partially ground controlled. Similarly, systems are being developed to control the light bomber throughout the approach, delivery, escape and return with extreme accuracy. They provide also a platform from which the pilot may navigate by celestial means, and rest between times.

Mach Number and Airspeed—These systems are not difficult to incorporate in an autopilot system, but have not been a requirement until recently. Mach control is very useful in an airplane whose climb schedule approximates a constant Mach number. Both will be useful in aircraft designed specifically for high altitude operation which are red-lined at a comparatively low indicated airspeed. Automatic climb control will hold the red-line airspeed until it is equal to the Mach number for best climb and then switch to Mach control.

Heading Selection and VOR Beam Guidance—These are related systems and are now being flown in a production commercial version and in an F-84E flight test system. Heading selection permits the pilot to pre-select a heading and initiate the turn by pressing a button. The beam guidance uses a mixture of the selected heading signal and the error signal received from the VOR. This system has been test flown in one F-86D using an ID-249A selector as a heading selector. Wind drift is correctible.

Where does this leave us airplane drivers, you ask? Well, there are at least two good reasons why the pilot cannot be completely replaced for years to come.

- Remote control range is limited to line of sight at present and is expected to be so limited until a new communication or observation concept is devised. Therefore, piloted aircraft must be retained for medium and long range interceptions and attack missions. In addition, tactical missile ranges cannot be increased appreciably before the economical size limit is reached.
- The aircraft and airborne equipment required for many missions is becoming such a large investment that it is not economical to leave this investment unattended. A pilot will be required to monitor the automatic equipment, to make decisions during the conduct of a mission and, in the event of equipment malfunction, to control the vehicle manually.

Missile applications will, of course, increase, and they may cut into the pilot's realm to a certain extent, but there will always be a place for the human touch. ●

the Good Old Daze

This story starts way back in the middle '40s and does not involve any supersonic aircraft. Still, its flying safety message applies today.

IT WAS BACK in the middle '40s after the European and Pacific wars had been won. At that time I was one of the many pilots who thought if an aircraft could fly, I could do as well flying it as anyone else. What a misled, egotistical fool I was, which you will plainly see as this story unfolds. I was fresh out of combat and was sure that since flak and enemy fighters were passé, flying would be just a breeze.

I was assigned to an organization in a western state to which were attached many subordinate units scattered throughout that area. My duty consisted mainly of flying "the Old Man" and his staff to visit or inspect those units. That alone kept me pretty busy. We had one C-45 assigned to the headquarters and its maximum utilization was, at best, far short of the flying required to accomplish our mission. So finally, we received authorization to have one additional aircraft assigned. This plane, a B-25, finally was delivered in the late fall of the year. It was ferried to us, completely equipped for combat, with the exception of a bombsight. Why that piece of equipment was not included, I will never know, because the airplane was equipped for firing rockets, guns and even for launching torpedoes.

Nevertheless, we had the problem of modifying the beast so it would be adaptable to the job for which it was assigned. This problem multiplied itself many times before the conversion was complete, but through the judicious application of uniform procedures, such as scrounging, midnight requisitioning and politicing, we had a B-25 ready to transport our people.

Well, we rolled her out on the ramp ready and raring to go, but now the only trouble was that we had no pilots who had flown or had experience in the B-25. So there we were with a nice, shiny airplane with no one to fly it. However, as luck would have it, there was a newly arrived pilot on the base who had been an instructor pilot in the B-25. He was not assigned to our organization, consequently we had to persuade his boss to permit him to check out two of our pilots. I was one of the fortunate two.

". . . so there was a nice, shiny airplane with no one in the squadron to fly it."

By this time, November was upon us, and as usual, Thanksgiving was approaching. As many readers will remember, back in those days, when a holiday rolled around everyone made the supreme effort to get home for the festivities.

It so happened that my home was on the East Coast, along with about seven others in the outfit. We all decided that Mom's Thanksgiving turkey would be much better than that served by our G.I. chefs. So from those seven, a committee of seven was appointed to talk me into a trip eastward for the holiday. After a heated discussion and many twists of my arm, which lasted every bit of 10 seconds, I condescended to oblige, if the boss man would approve and if I could be checked out in the B-25 before the holiday. The boss gave his approval, but we were having difficulty in tying down our instructor, so the checkout ride was the big sweat.

Finally, the day before Thanksgiving, we made arrangements for our instructor to give us the check-out ride. The other pilot and I had studied and restudied the tech orders on the aircraft and were fairly familiar with every procedure and working part involved in operating the airplane. All we needed was flight experience.

By this time we were chomping at the bit to fly this bird, but, as usual, our instructor pilot was busy that day and didn't show until late in the afternoon. As a result, we had time for only a few stalls and three landings before darkness overtook us. It was decided before takeoff that since time was so short, only one of us would fly in the left seat. So, who do you think got that privilege? Right. The one with the highest rank, which I was not. I stood on the flight deck behind the two pilots and watched. At the end of the day, however, both of us possessed a valid certificate stating that we were qualified to fly the B-25. So, with that, I was ready for the holiday cross-country flight—on paper, that is.

With all the minor details taken care of, we all met that Thanksgiving morning at 0400 on the flight line. I was the only pilot in the group. There was only one other flight crew person with us, the engineer. We were all ready to go when we discovered that the aircraft had not been refueled since the flight on the previous day. So after much running and calling hither, thither and yon, we managed to get the fuel trucks to the plane, and completed refueling operations.

At approximately 0630 we taxied into position and received clearance for immediate takeoff. When we gained sufficient speed to be airborne, I thought, "Boy, how do you know that you can get this thing back on the ground in one piece?" For that I had no answer and too little runway left to chop throttles and abort, so on we merrily roared.

Once airborne, I knew that we were to head east, but that was all. I remembered suddenly that I had forgotten to obtain charts or draw up a flight plan. We searched the plane for maps, but none were to be found. We did, however, find a current Radio Facility Chart and it just so happened that the airways led to the base of first intended landing.

The weather was beautiful; not a cloud was in the sky and the sun had just risen. We were doing fine since the old faithful bird dog was pointing the way from one radio range to the next. After about two hours of clear weather flying, suddenly there appeared ahead and below, the dreaded forms—CLOUDS. We tooled on, with a safe margin between us and the undercast. This margin, however, was mysteriously short-lived. The milky puffs were gradually coming up to our altitude.

So I took normal action to correct the situation by nursing the airplane higher and higher until we were at 10,000 feet. At this point, I guess I did the only correct thing during the entire trip. Since there was no oxygen on board I would not go higher. By remaining at this altitude we were soon in the soup. Any normal person would have called a ground station for further clearance long before this, but as you've probably guessed, I was not normal that day.

So there I was on instruments in a terrible snowstorm. I soon figured that we were not likely to run out of the bad weather, so I thought that it might be a good idea to let down and try to get under the clouds. By interpolating the field elevations given in the Radio Facility Chart, I guessed at how low we could fly without doing some spring plowing in the dead of winter. Down, down, down we went to what I figured to be about 700 feet above the terrain. Sure enough, every now and then we could see the ground so I climbed an additional 300 feet for safety. Strange how that word should appear in this story.

Shortly there appeared a large body of water below us which shook me no end. I was afraid that we were over one of the Great Lakes and if this was true, we were really lost. But, thank goodness, we were soon over land again and could see the blur of a city below us. In short order old "Bowser the Bird Dog" took a 180-degree turn, telling me that this was the point of first intended landing. Back to my trusty Radio Facility Chart I went to find the distance and bearing from the radio station to the field. Using this information and applying the solution of a rough time—distance problem I knew that we should be over the field —and what do you know, we were.

You have heard of it raining "cats and dogs," well, this snowstorm could easily have been referred to as "snowing elephants and hippopotamuses."

The tower was much relieved to receive our call and gave me landing instructions, but by that time the field was lost in the snowstorm. If a cloudburst could be referred to as "raining cats and dogs," then this snowstorm could easily have been referred to as "snowing elephants and hippopotamuses."

Luckily, we found the field again through systematic blind search and I set up a close-in rectangular pattern. As soon as I turned on the crosswind leg the field was lost from sight again. By timing each leg of the pattern I hoped to make a perfect rectangle and be lined up with the runway on the final approach. Right again, dear reader, I was not.

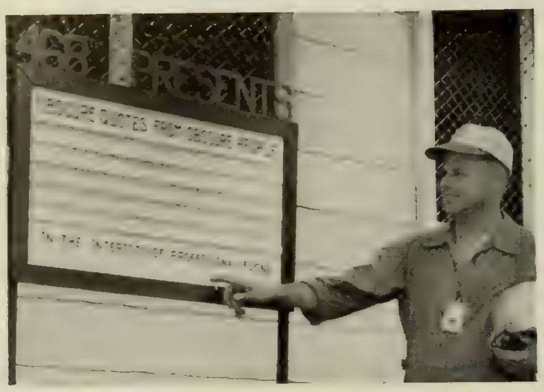
I was about 500 yards to the left when visibility was good enough to ascertain our exact position in relation to the runway. I racked her up to the right in an effort to line up with the runway. As a safety factor, I maintained an airspeed of 150 mph, so when we were over the runway I still had too much speed to set her down. I lowered full flaps, but we were still too fast to make the landing. I gave her full throttle and called for gear up. The engineer pulled up the gear all right, but also pulled up the full flaps and we cleared the fence by what seemed to be only a foot or two. On the next attempt I was more fortunate. The runway was dead ahead and I had sufficient time on this try to reduce airspeed for the first landing I had ever made in a B-25.

After securing the aircraft and chewing out the engineer for retracting full flaps all at once, I decided that we would not attempt to reach our final destination for that holiday. Everyone else agreed to this, so we decided to stay right there until the following Sunday.

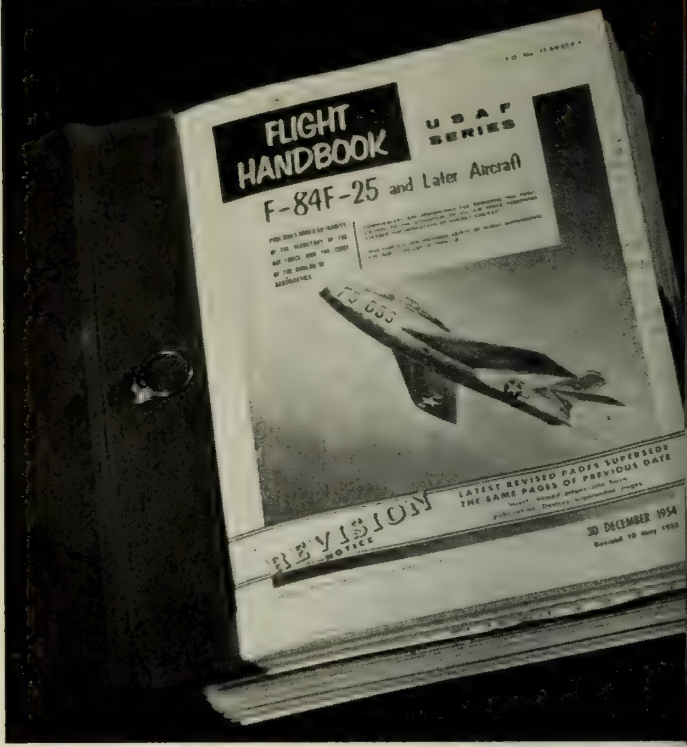
After having a rather mild holiday we proceeded to the field to prepare for our scheduled return flight. This time I obtained maps for the entire United States with routes drawn to every field within range of the aircraft. I was briefed properly and we arrived as planned.

If Major (he must have been a lieutenant then) Rex Riley and his good looking secretary had gotten wind of this comedy of errors, he could have published a series of comic books rather than a one-page poster. Fortunately, for some unknown reason, my violations were not cited, but the many nightmares I have had of that flight and the many hours of afterthought have taught me to be more respectful of aircraft, flying regulations and flight planning.

Now I don't dare even fly around the flagpole without a detailed flight plan and sufficient maps to help me navigate to an emergency destination. This experience certainly did much to make me more conscious of the need for a flying safety program to educate and keep pilots abreast of new developments and to apply the accepted and proved principles of safe flight. I do not recommend a similar escapade for pilots to become more mature in their profession and even if anyone should be so ignorant as to undertake such, I am thankful that our people and facilities have improved to such a state as to prevent them from doing it. ●



From the classics to a pair of galloping dominoes—most anything is grist for the mill in this squadron's accident prevention program.



Imagination can make a flight safety program. And sometimes it takes only ... a

We all know that flying safety is a never-ending thing. You can't just go and get a shot of it once a year and expect to keep your accident potential down around the zero mark. If you are not up to date, if you do not keep abreast of the latest procedures and techniques, you are a flying Form 14 looking for a place to really happen.

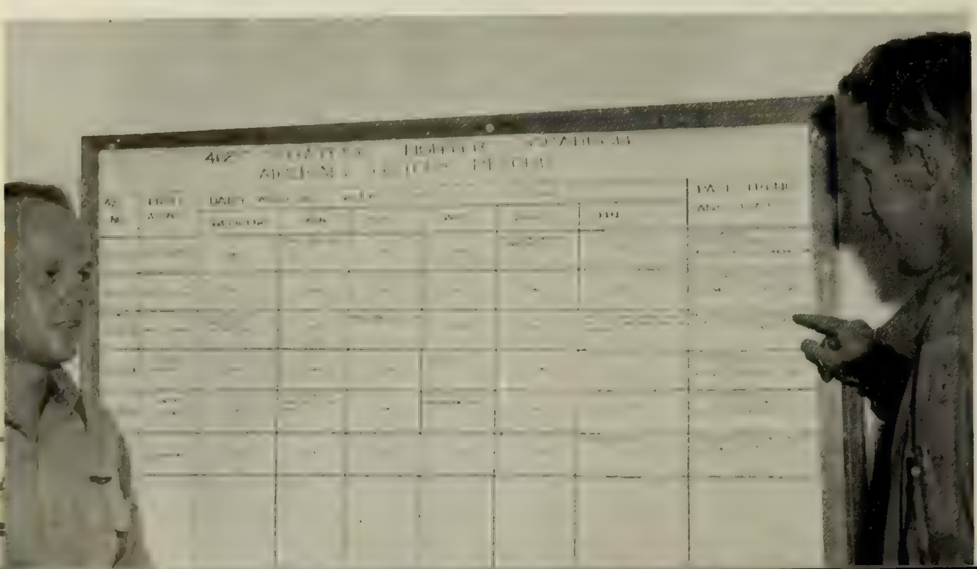
Now whether you realize it or not, there is at least one fella around your base who is trying to make it easy for you. He is working like a trooper so that you can get all of the latest information required to keep you from becoming a statistic.

I think we all go along with the idea expressed in the old adage "The best place to look for a helping hand is at the end of your arm." Still, a little assistance from the FSO can go a long way. He has access to the information that is so essential to you as a pilot.

Believe it or not, many FSOs have trouble keeping pilots in a flying safety mood. Here is a story about one such FSO who, through imagination and hard work, has come up with a real, first class, flying safety program every day of every month.

A cigar box, a pair of dice, a slip of paper and a twist of the wrist. Simple little things, aren't they? Believe it or not they are one way to spell flying safety. You don't believe it? Read on, MacDuff, and see. It is just another example of how an FSO helps you to help yourself.

Trend board helps pilots check history of squadron aircraft through a summary of write-ups, corrective actions and appropriate remarks.

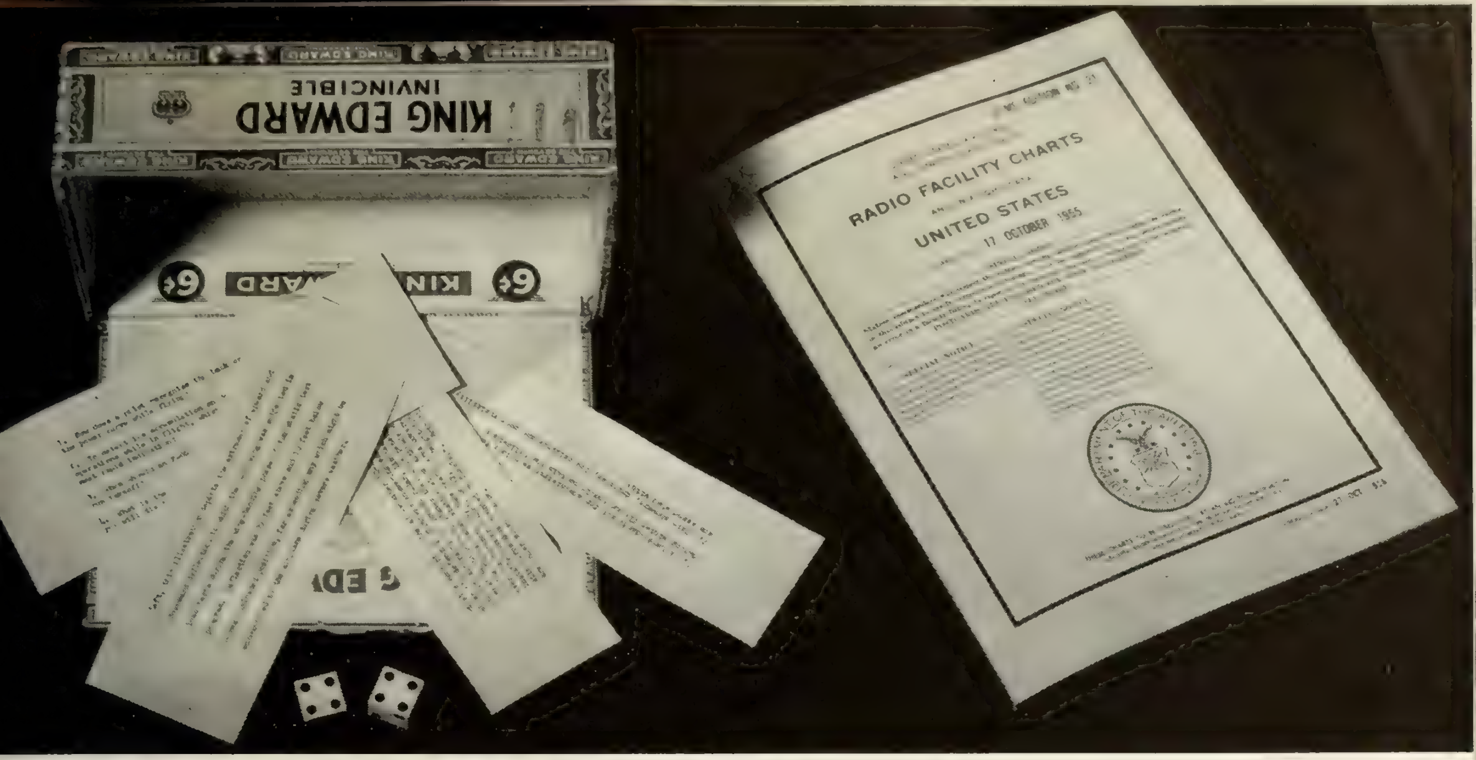


EVERY MORNING in the 468th Strategic Fighter Squadron, Turner Air Force Base, Georgia, there is a pilots meeting. Capt. Lloyd R. Leavitt, FSO, opens up the lid of his Fly Wise cigar box, rolls a pair of dice, picks up a slip of paper and kicks a highly aggressive flying safety program off to a fast start.

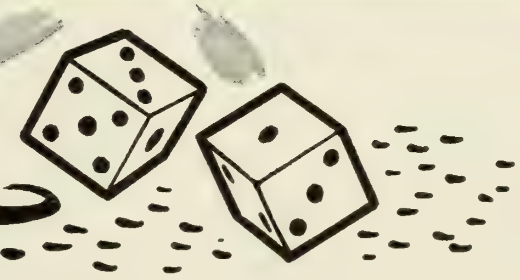
This little gimmick of rolling the dice is a good twist. The dots on one of the dice stands for a particular flight of the squadron. The dots on the other dice stands for a member of this flight. The slips of paper cover practically every sentence of the Dash One. Also thrown in are innumerable questions on the Fac Charts, Supplementary Flight Information and various phases of weather.

Throw in 30 pilots about equally divided between old heads and new types and you have an intensive effort to excel in knowing the F-84F. There's only one answer. They realize that they must really know their aircraft in order to remain professionals at their jobs.

But this is only a third of the story. Perhaps equalling their approach and



roll of the



attitude toward flying safety is another tool which they use to perfection. A trend board is kept up to date in the briefing room. This is more than an ordinary eye-wash trend board. It's this squadron's bread and butter board.

This trend board includes the history of each aircraft. Here the past history of write-ups, corrective action or appropriate remarks can be witnessed by all pilots. It becomes a matter of personal interest to all the pilots as to what is presently wrong with the bird, what has been wrong with it, whether the ailment is a recurring disease or if some specific trend is starting to develop.

To these jet guiders, history means that if 25869 has been a "hangar queen," what remedial action has been taken to right her? They are downright persistent about these recurring squawks.

Another good angle that the 468th uses is having the Indians help the Chief. Meaning that Capt. Leavitt, who is leader of Flight D, has each member of his flight assisting him. One handles the incident reports. Another carries the duty of maintenance records. Next is an officer in charge of daily questions. The fourth member is squadron representative to the wing standardization board. The fifth is ground safety officer with special reference to policing the ramp for unassimilative articles which might be gulped up into the airscoops. The sixth lieutenant troubleshoots aborts and malfunctions.

Still another method is used to keep flying safety uppermost in the minds of the jockeys. An "Obscure Quotes from Obscure Pilots" board outside Ops causes a momentary pause when entering the building. It's a take-off on historical quotes. They are worded into flying phraseology. Hamlet really takes a beating sometimes.

The words "just routine" are regarded as the first step to an incident, and after an incident an accident might occur. So a stuck canopy, unusual engine noise or vibration in flight, or any of a dozen little items that are not normally associated with an "F" when in tip-top shape is cause to alert the FSO. The individual plane crew chief is read into the act. Then the line chief. How many emergencies have been prevented by this constant safety attitude on the part of every pilot is only a matter of conjecture, but you can bet it's plenty.

The 508th SF Wing, commanded by Col. Gerald W. Johnson, has a hand in the program, of course. A couple of wing FSOs, Captain Joseph Ross and Donald James, spend the better half of each day on the line, while Capt. John Fritz, wing standardization board, keeps the lads well clued-in on techniques and SOPs.

Well, there you have it. The cigar box, marked dice, slips of paper and an entire squadron of pilots who vie with each other as to knowledge of the F-84F. An every-morning study of a trend board that is more than a chart on a wall, a talking over of any trend that is developing to nip it in the bud and a thoroughness about their job puts them in the "professional" class.

The 468th concept of flying safety is to treat the just routine cases with kid gloves. It's a free Air Force and all rights on the ideas used by the 468th are not reserved. ●

REX SAYS

I HAD A near-miss that involved frost, clear ice and a miscalculated freight manifest that shook me to the marrow of my bones. In fact, whenever I tell it to others, I still get a bit queasy.

I was flying a C-47D in South America and had been delayed on the second leg of my scheduled run because of fog. There was a considerable amount of freight on board.

That evening I was contacted by a representative of the U. S. Government, and he asked if I could take on a couple of thousand pounds of freight for him to my next stop. I did some mental calculations and said yes.

Now comes the hairy part. The field was one of these jobs that sets in a nest of hills like the bottom of a coffee cup. It was during the winter season and the temperature was hovering around the freezing point.

I arrived at the field at 0400 hours and, along with the copilot and crew chief, scraped loose the accumulated frost that had formed on the wings. We figured it would blow off when we started takeoff. I checked the form F after it had been recomputed by the freight agent, and climbed over many boxes en route to the cockpit.

The runway was 6500 feet long and made of concrete. There was an intersecting runway about 3000 feet from point of takeoff. It's a good thing I remembered this.

As the aircraft started to roll, the copilot told me that the remaining frost was blowing off the wings, so I continued the takeoff. The ship was very sluggish, but considering the load we had, this figured, so I just let 'er roll.

Out of the corner of my eye, I saw the 300 foot intersection go by and the tail had not even started to fly yet. I shoved forward on the control column and the tail came up, but promptly returned rapidly to the runway again.

This was enough for me. I aborted and came to a shuddering halt just inches from the end of the strip. I taxied back and parked.

Know what I found? A good bit of the frost on the wings and tail had not blown off. A quarter-inch of clear ice covered all of the flat surfaces. Evidently it was caused by a heavy dew that froze prior to the formation of the frost. A re-weighing of the cargo revealed that the freight loader had figured the added cargo using the metric scales. Weights shown in pounds actually were kilograms and the plane was 4000 pounds overweight.

All in all, I guess I was indeed lucky. If there had been no frost, or if the dew had not frozen on the aircraft, or if the weights had been correctly figured, I probably would not be here to discuss this near-miss. Any one of the three factors would have allowed the ship to become airborne, but the rate of climb would have been nil. In addition, the reactions of the aircraft would definitely have been seriously impaired. And remember, this base was surrounded by hills, with very high mountains nearby.

Can you see why I still break out in a cold sweat when I think of this near-miss?

REX SAYS*—The old Gooney may make up for a lot of mistakes but this lucky chap was stretching things a bit too far. Glad he's still around to bring out a good winter axiom—the frost on the pumpkins in November can still be on the dew in January.*

★

A VERY DISTURBED and shaken pilot recently called a Flight Service Center to report a flight of fighters which had buzzed dangerously close to his aircraft. Their approach had been so fast and sudden that evasive action was impossible. Further conversation with the pilot revealed the reason for the "reckless" maneuvers of the fighter aircraft. They were making a high speed bomb run in an established and well defined restricted area. When confronted with this, the reporting pilot expressed surprise. He had not been aware that a dangerous and active restricted area lay across his path of flight.

Unfortunately, this is not an isolated case. Similar incidents are happening with alarming frequency. In some instances pilots are not even aware that only the vigilance and skill of a fighter pilot had saved their lives. The pilot of an F-84F graphically described such an incident.

"I was in a 60-degree dive, indicating 415 knots over Plum Tree (Plum Tree Range, R-49), when the flight commander called a break for me. I looked up and all I could see was a large four-engine aircraft. I discontinued my run and took the number from the aircraft which was on a heading of approximately 20 degrees at 10,000 feet. Had my flight commander not called this bogey, a mid-air collision surely would have taken place."

Only the alertness of the flight commander prevented this from being a major air disaster. The next bogey may not be so fortunate.

In another instance, a twin-engine aircraft flew through this dive bombing range. Two F-84F aircraft were in the middle of a high altitude dive bombing run when this plane suddenly appeared under them. Only quick action upon the part of the lead fighter pilot prevented a collision.

And here is the payoff. Just one hour later, another twin-engine aircraft flew through the range during another bombing run, at approximately the same altitude and heading.

In one month, a total of five violations were made on the Plum Tree Island Bombing Range (R-49) during dive bombing training. Or to put it another way, five pilots were caught and had violations filed against them. Undoubtedly, other planes slipped through unobserved. Of the five, two were airliners, and the other three represented different branches of the military service.

Why do pilots fly through restricted areas when hazards to flight are known to exist? The stock answers to this question are: "I forgot." or "I've flown through that area before without any trouble." (Sounds strangely familiar to the infamous last words, "No sweat—this is my home station.") But the classic reply is, "What restricted area?" None of these answers are acceptable by violation review authorities who are generally of the opinion that lapse of memory and ignorance of directives are inexcusable.

Don't compromise the safety of your passengers, crewmen and aircraft. Check en route prohibited, restricted, and warning areas. A list of those areas is contained in current Radio Facilities Charts.

If you must make a flight to a base within a restricted area, obtain prior clearance from competent authority. Your proposed entry should also be coordinated with the command responsible for controlling the restricted area. And don't forget to check the

REX SPECIALS

Occasionally, I receive material not concerned with the incidents that normally appear in this section. But when information other than near-miss reports comes up that is especially important, I will run it as a special part of REX SAYS.

This short article on the inclined turn and bank indicator was written by George H. Purcell, an employee of the Flight Control Laboratory, WADC.

ON THE F-86D, F-100 and F-102 aircraft, a problem has arisen because the turn and bank indicator is mounted on an inclined section of the instrument panel. Tilting the face of the dial upward has made it easier to see and read, but has seriously reduced its performance as a standby instrument. It appears that the instrument's indication during partial panel operation (where the turn and bank indicator is the only gyro instrument used), might be confusing to the pilot. This applies particularly to the F-86D and F-102 where the instrument is inclined about 15 degrees. On the F-100, the panel is inclined only about 10 degrees and the effect is less pronounced. But, even here partial panel operation under IFR conditions would be exceedingly difficult, at best.

Since the basic mechanism in this instrument is a gyroscope, the indication it provides is influenced by the angle of mounting in the aircraft. It was designed to show rates of turn correctly when mounted on a vertical panel. When it is inclined in a manner to tilt the face upward, the needle is affected adversely. It is deflected, not only by the turn rate, but also by a roll rate, due to the angle of instrument installation. Thus the needle gives an erroneous reading. At a 15-degree inclination, about 26 per cent of the roll rate is measured; while at a 10-degree inclination about 17 per cent is measured. Since roll rates are generally much higher than turn rates, it is obvious that a large proportion of the indication at any instant can be due to rolling.

For example, assume that the pilot is on instruments and that the attitude indicator is inoperative, making it necessary for him to rely on the turn and bank indicator. Let's assume further that he desires to make a turn to the left from straight and level flight. The pilot starts this turn by moving the stick to the left. As the aircraft begins to roll, the turn and bank indicator erroneously shows a turn to the right, because it is sensitive to rate of roll. When the pilot sees this he naturally moves the stick further to the left, thereby increasing the rate of roll to the left and consequently increasing the indication on the instrument of a turn to the right.

During this time, the bank angle to the left is increasing, causing the turn rate to the left to increase. This provides an input to the indicator tending to cancel the erroneous indications caused by the rate of roll input. However, if the pilot tries hard to control the aircraft with reference to the indication, it seems probable that the aircraft could be out of control before this compensating input would be effective. Rough air could be expected to aggravate this unusual flying condition.

It should be emphasized that the characteristics described, apply to the instrument only when it is being used as a substitute for the attitude indicator. If the attitude indicator is operating properly and is used as the primary, basic flight instrument, then the turn and bank indicator should be perfectly satisfactory for holding prescribed rates of turn. The reason for this is that after establishing a constant bank, the roll rate is zero and therefore the input of roll signal to the indicator is zero.

The above comments are based on computations, limited flight tests and unsatisfactory reports from organizations using the F-86D. More thorough testing both in flight and using flight simulators is being performed at WADC. More exact and quantitative data on details of this problem can be expected. The possibility of inclining the gyro mechanism in the instrument case in the direction to compensate for this effect also is being investigated. Action already has been started to move the instrument back to the vertical position in the F-86D and probably this change also will be made in the F-100 and F-102.

In the meantime, pilots should keep in mind that the turn and bank indicator can give confusing indications on the three aircraft listed above.

Remember, that aircraft participating in restricted-area maneuvers are simulating actual combat capabilities. So beware and stay clear.

NOTAM file for special information pertaining to hours of operation and type of activity in progress. Additional instructions for entering restricted areas can be found in the Special Notices Section, Radio Facilities Charts.

Remember that bombers and fighters participating in restricted-area maneuvers are simulating actual combat capabilities. Disruption of their missions may delay vital tactical projects for days as well as expose personnel and equipment to unnecessary dangers. Consider these factors the next time you plan a flight.

REX SAYS—*The gent who sent me the above well put-together narrative is an ops officer in a Flight Service squadron. His comments concerning these violations make a lot of sense to me. The pilots involved in these incidents are really asking for trouble and, if they keep on disregarding restricted areas, someone is going to get it. The worst part of the whole deal is that all five had passengers and crewmen with them. All restricted, prohibited and warning areas are available to a pilot in his Fac Chart; there can be no excuse for not using it.*

It all goes back to a point that seems to need endless repeating—Plan Your Flight!

★

I'LL BET THE manufacturers of the T-33 didn't know they had a built-in magnifying glass when they sold the T-Bird to the Air Force.

As I was patrolling the flight line one hot summer afternoon, I took a second look at the rear seat of a '33 and saw a blaze coming from the instrument flying hood.

Fortunately, it didn't have a real good start and the fire department extinguished the blaze quickly. After this episode I made the rounds of the maintenance shacks. It was agreed generally that the old Boy Scout method of making fire with a piece of glass wasn't what Lockheed had in mind when they stuck the canopy on the T-33.

REX SAYS—*Old Sol bore down in this case. The remedy . . . keep the canopy cover in place. I might add, this is the third or fourth time this has happened in T-Birds.*

★

YOU KNOW, it's one thing to see a jet go by, but it is something else to hear one go by. I had this happen to me one day while I was flying just west of Gila Bend, Arizona, on a DVFR clearance on Red 9 Airways at 8000 feet.

I had the side window cracked in my C-47, as we were trying to suck the hot air out of the cockpit. I was figuring out my ETA for San Diego and the copilot was doing his hitch at the aircraft's controls.

I heard a SWISH! I looked over at the copilot and asked, "Did you see it?" There was no mistaking that it was a jet.

He looked sort of ashen-faced while he related that it was a jet fighter on a collision course and that it had gone over the top of us at no more than "25 or 30 feet."

I'd seen a lot of jets go by me while plodding along in a Gooney but this was the first time I had ever heard one. The copilot had no time to maneuver from the time the jet was sighted until it was gone.

I wonder if the jet pilot was just playing around or whether he didn't see us? Either way it was much too close for comfort. I know two things.

First, that we were at the right altitude and second, that if the two aircraft had met head on at somewhere near 700 miles per hour, someone would have been hurt.

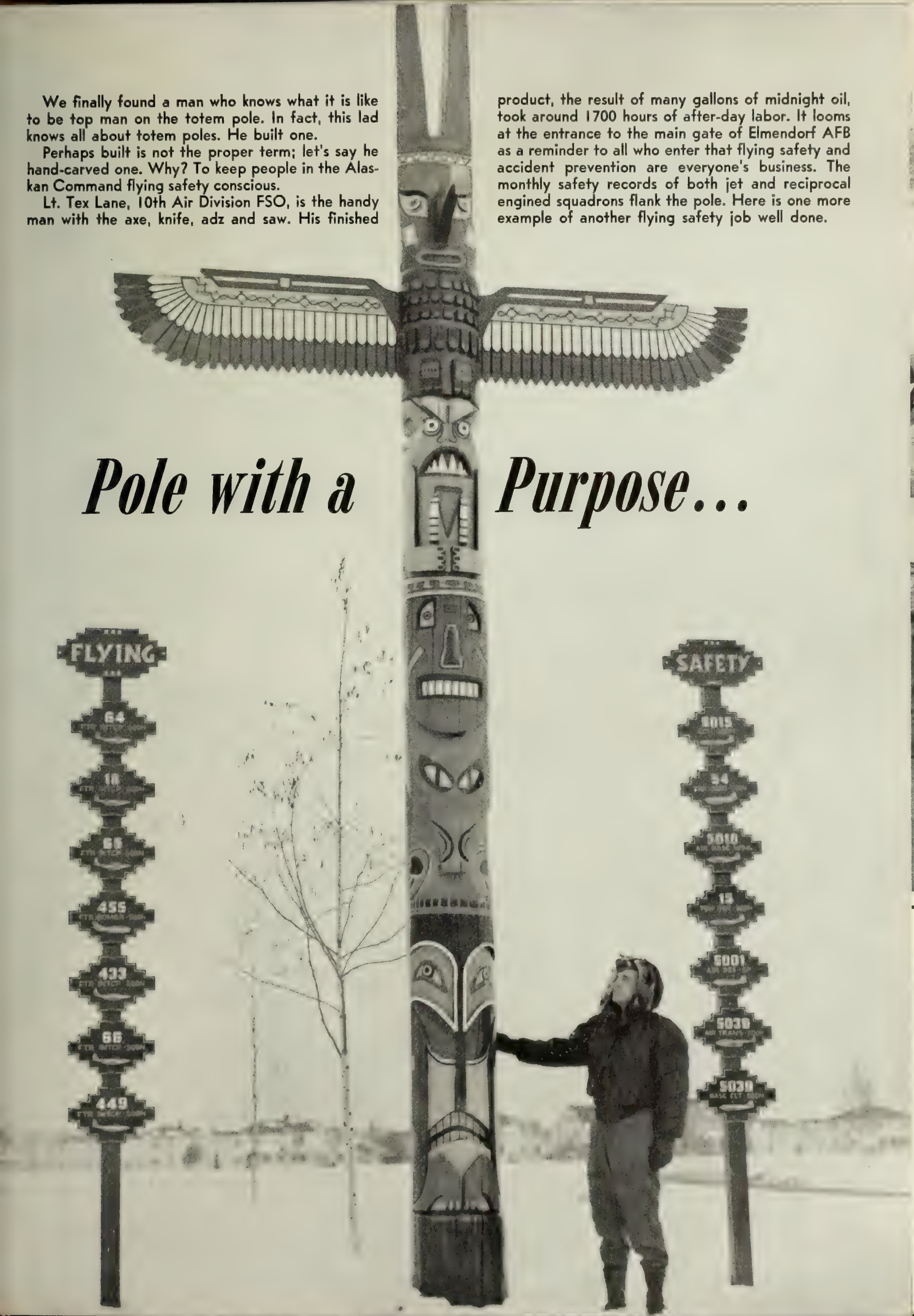
REX SAYS—*Far too often we all hear about some near head-on collision. When do they happen? During VFR flying conditions. Looks as if some jet lad had no business Mach-ing along at this altitude. Heck of a way to use up JP fuel, I might add.*

We finally found a man who knows what it is like to be top man on the totem pole. In fact, this lad knows all about totem poles. He built one.

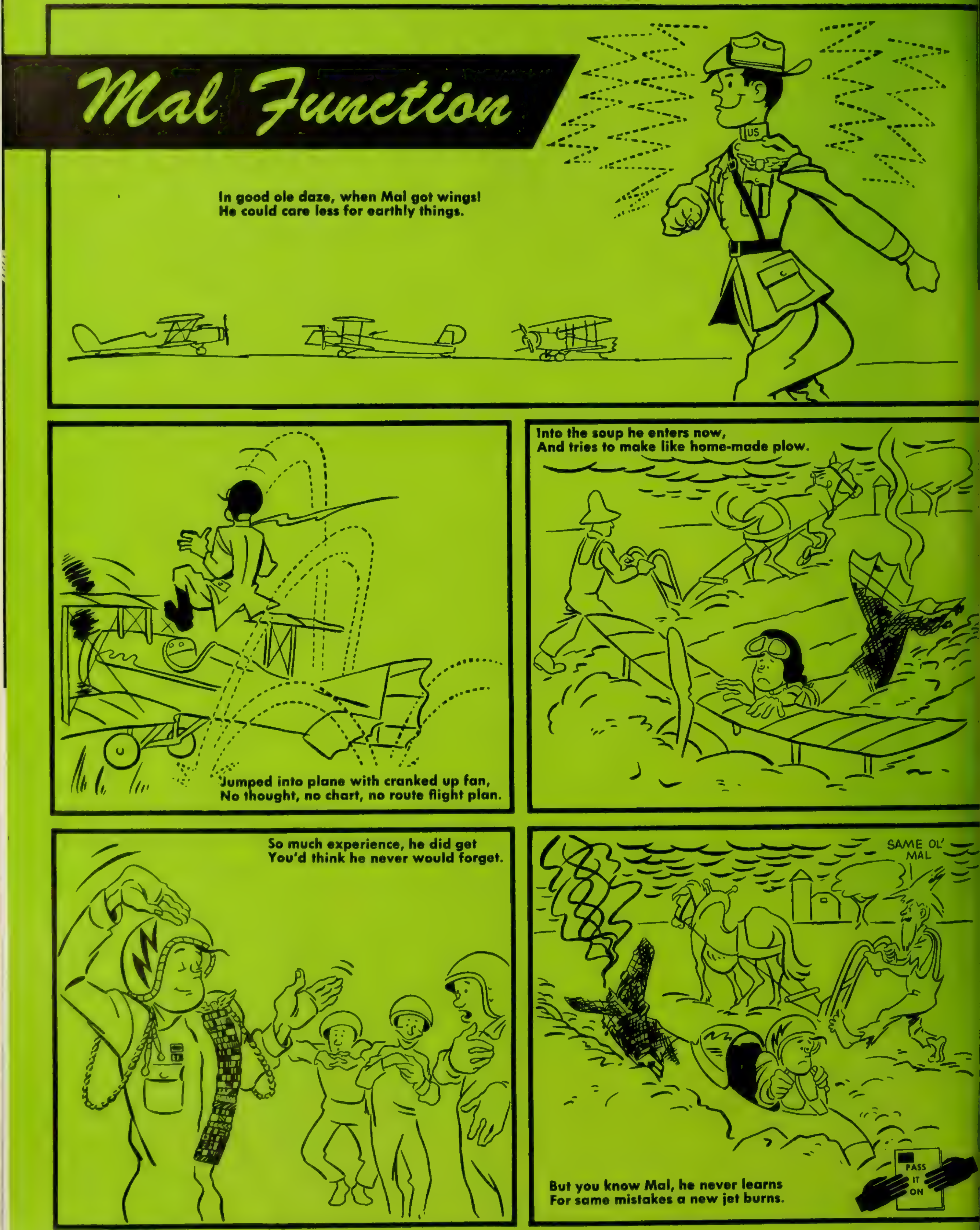
Perhaps built is not the proper term; let's say he hand-carved one. Why? To keep people in the Alaskan Command flying safety conscious.

Lt. Tex Lane, 10th Air Division FSO, is the handy man with the axe, knife, adz and saw. His finished product, the result of many gallons of midnight oil, took around 1700 hours of after-day labor. It looms at the entrance to the main gate of Elmendorf AFB as a reminder to all who enter that flying safety and accident prevention are everyone's business. The monthly safety records of both jet and reciprocal engined squadrons flank the pole. Here is one more example of another flying safety job well done.

Pole with a Purpose...



Mal Function


In good ole daze, when Mal got wings!
He could care less for earthly things.
US
Jumped into plane with cranked up fan,
No thought, no chart, no route flight plan.
Into the soup he enters now,
And tries to make like home-made plow.
So much experience, he did get
You'd think he never would forget.
SAME OL' MAL
But you know Mal, he never learns
For same mistakes a new jet burns.
PASS IT ON

©U. S. GOVERNMENT PRINTING OFFICE . . . 362330

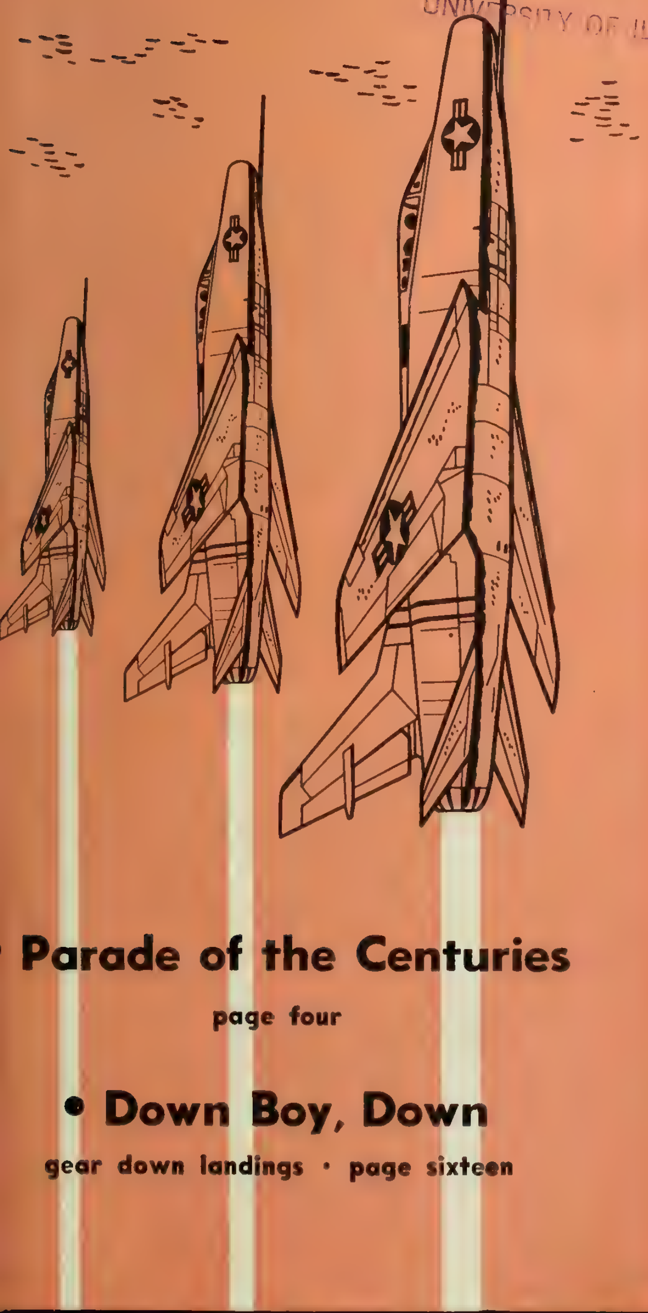
629.1305
Flys

FLYING SAFETY

UNITED STATES AIR FORCE

FEBRUARY 1956

THE LIBRARY OF THE
FEB 1956
UNIVERSITY OF ILLINOIS



Parade of the Centuries

page four

• Down Boy, Down

gear down landings · page sixteen

FLYING SAFETY

VOL. TWELVE NO. TWO

- In the months to come, you'll be getting the low-down on the high-ups, namely, the Century series aircraft. Page 4 features some flying characteristics of the first century, the F-100.

- If you want to keep up with the latest fashions in wearing apparel, you'll enjoy "Fashioned for High Living," on page 24.

- If you are flying a jet fighter and ever have to set her down on any unprepared ground, let the gear absorb the shock for you. See page 16 for details.

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director
Directorate of Flight Safety Research
Norton Air Force Base, California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

STAFF

Editor
Major Perry J. Dahl

Managing Editor
Maj. Jesse F. Townshend, Jr.

Art Editor
M/Sgt. Steven Hotch

PRODUCTION

Major Ben H. Newby
T/Sgt. Nicholas Shekita, Jr.

T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune

T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

Page

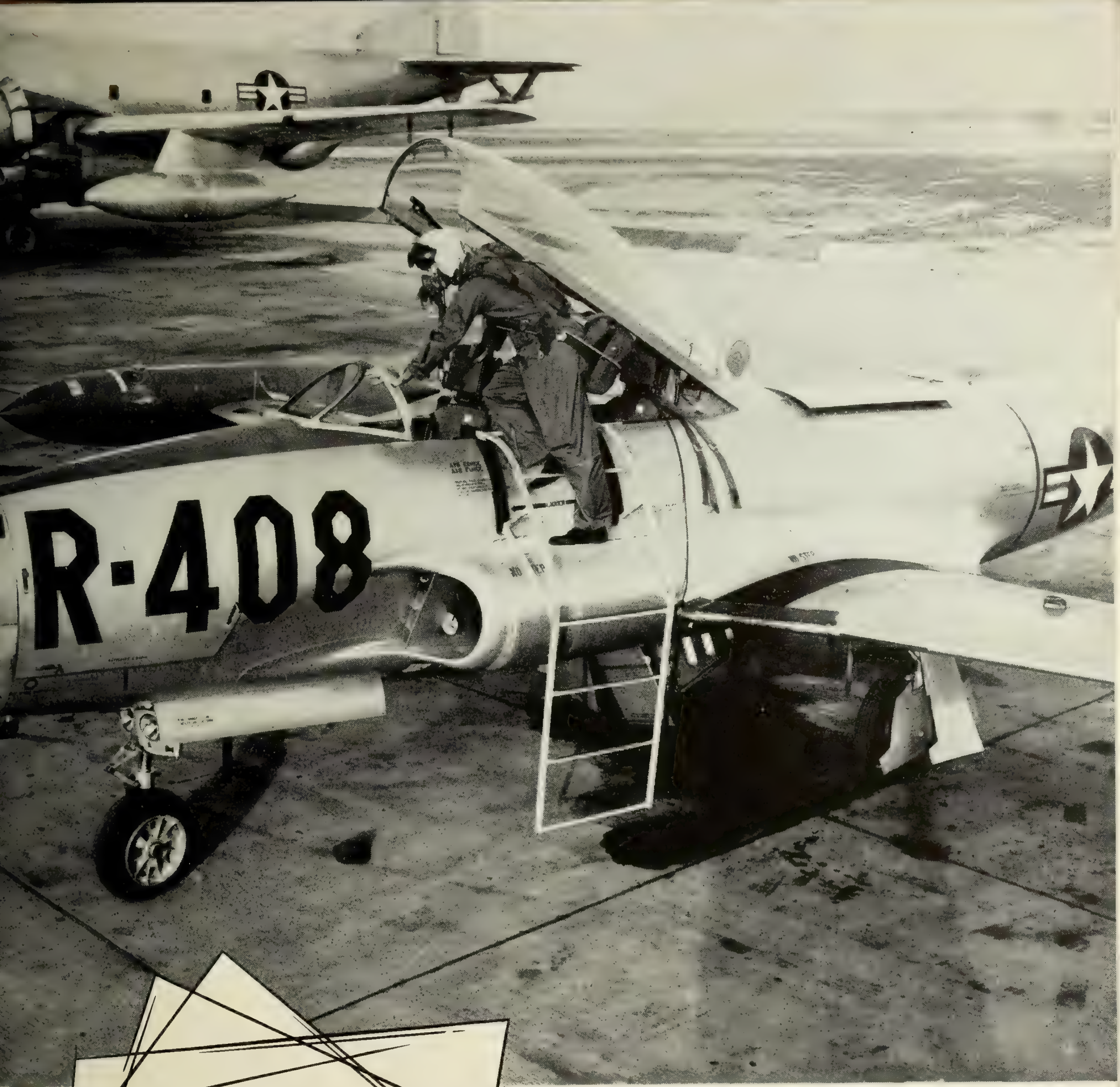
Crossfeed 2
Parade of the Centuries 4
Keep Current 14
Down, Boy, Down! 16
Well Done 21
Rex Says 22
Fashioned for High Living 24

★ ★ ★

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1



LOOK BEFORE YOU LEAP!

● Would you roar off in this T-33 the way it stands here? Take a good, long look and see how many items this pilot missed on his walk-around inspection. Accidents can be caused by such carelessness. Turn to page 14 and check your answers with the labeled photo.

LETTERS TO THE EDITOR

OMNI Tips

Here is some additional information on OMNI angles that may be of interest to your readers. You can fly a direct flight off airways to save time and fuel or maybe just to go around some seat-belt weather. This procedure is written for you folks who fly aircraft equipped with the AN/ARN-14. As far as equipment goes, you need an ID-249 Course Indicator, while a RMI (Remote Magnetic Indicator) is handy, but not necessary.

Plot your course on a map similar to the jet navigation type (JN) that has the OMNI stations plotted. Remember to pick an altitude high enough to receive OMNI stations that are off your wingtip or intended line of flight, as listed on page 4 of the Radio Facility Charts.

Now let's go on a simulated cross-country. Refer to accompanying diagram. We take off and climb to altitude on our intended heading and make our usual rough guess on ETA and MH at point One on the chart. Prior to reaching point One, we set our OMNI receiver to station A and put a course of 110 degrees in our ID 249 selector window.

Measure the distance from departure to point One as 75 NM. When your ID 249 vertical needle centers, note the time in minutes and seconds. Change the course in the ID 249 window to 120 degrees for a 10-degree bearing change (or 20 degrees if close to station). While you are waiting for your vertical needle to center again, find the groundspeed from departure to the radial of 110 degrees or, let's say, 270 knots.

When our vertical needle centers at 120 degrees we note our time again and apply our formula of 60 divided by 10 degrees, which equals six. Take six times the amount it took for the bearing change from 110 degrees to 120 degrees, say two minutes. That puts us 12 minutes out from station A. Then put the GS on the E6B and look at 12 minutes and it tells us we were exactly 54 NM from station A on a magnetic radial of 110 degrees.

Plot it on your map and readjust your heading, if necessary, for drift from intended line of flight and compute ETA for point Two.

Prior to reaching point Two, set the OMNI set to station B and the course window to 290 degrees and do it all over again.

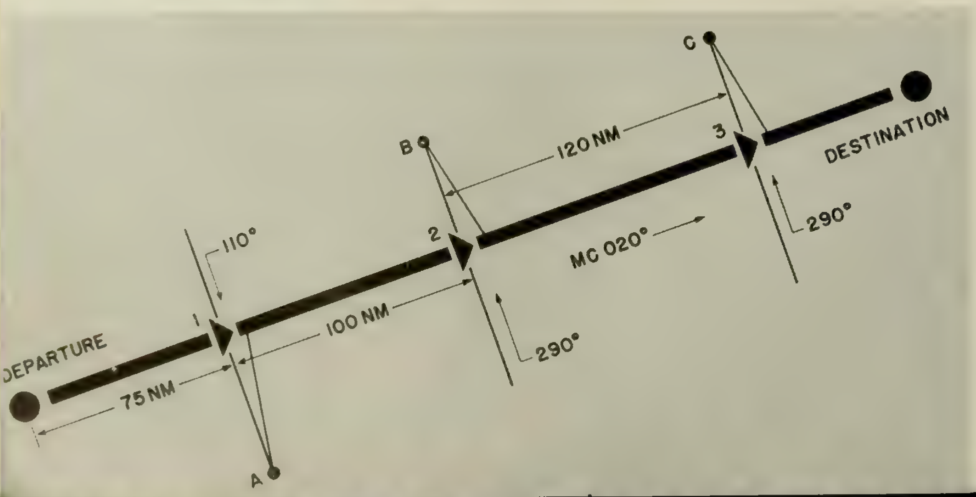
This procedure requires minimum equipment. A clock, compass, OMNI receiver and indicator, an ID 249, map, pencil, computer and a straight edge or Weems plotter. If you have a map or Facility Chart that doesn't have a compass rose plotted around the station then a Weems plotter becomes necessary. Of course, if you have a DME instrument on board the formula is not necessary.

Next time you're out on a flight, try it. It works like a charm.

Capt. Joseph A. Buebe
C-118 Instructor
1741st AT MTTU Sq
Palm Beach AFB, Fla.

Class dismissed.

Use this diagram and convince yourself that the above article can be helpful in your flying.



★ ★ ★

Dynamite Cap Maybe

While reading the November issue of FLYING SAFETY, I had an idea that I believe has some merit.

I was reading the column, "Rex Says," and specifically the article about the pitot cover being left on, and how the pilot tried to burn it off by turning the pitot heat toggle switch ON. This, of course, failed, but couldn't the pitot covers be made of an inflammable material with a highly inflammable spot or cap that could be ignited by the heat furnished by the pitot heater?

M/Sgt Leonard G. Stamets, Jr.
Tyndall AFB, Florida

This idea has been kicked around; however, the majority feels that the best way to get the pitot cover off is to do it by hand before takeoff.

★ ★ ★

Well Done Awards

". . . For quite some time now we have enjoyed reading about some guy or guys featured as "Well Done" award winners in Flying Safety magazine. We look forward to this page. Just recently while talking over a "Well Done," one of the boys wondered out loud 'what becomes of the recommendations the Award Committee passes over'—so we've decided to write and ask."

M/Sgt Alan Adams, USAF
520th Maint Sq, APO 10

FLYING SAFETY is aware of some outstanding reports that must of necessity go unrecognized, and has been considering a suggestion that we run some of them as items in the REX SAYS column. Perhaps this means of recognition would be acceptable to those crewmembers who do not receive the award, though they were nominated as candidates. Anybody else have any thoughts on the idea?

★ ★ ★

For Low and Slow

I am stationed at Hondo Air Base, a primary contract school, near San Antonio. There are numerous Air Force bases in this vicinity and it is interesting to notice the planes that circle our base trying to tell which one they are over. It is well to say that they should learn to read maps. use radio aids, and so on, but from a safety viewpoint as well as economy (fuel and time), why not paint the name of the Air Force base on a runway, ramp or hangar in large letters at each base? If this saved one plane, it would more than pay for the paint.

Capt. Dale H. Baker
Hondo Air Base, Tex.

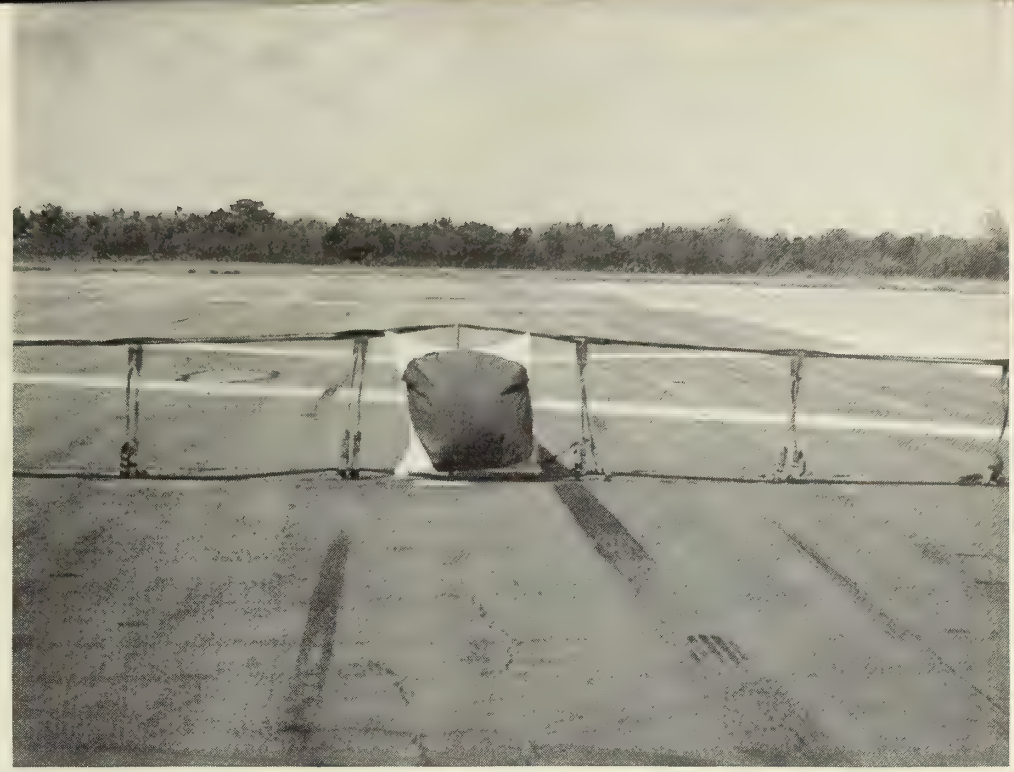
We did considerable cross-checking on this idea. It's fine for the slower, low-flying types of aircraft but not too suitable for jets. During night time operations it would mean incorporating a system of lighting that might be confusing. Anyone care to offer a comment?

★ ★ ★

It's a Bull's-Eye!

Here's a photo that you bull's-eye artists will get a charge out of.

Our runway is equipped with a barrier on the takeoff end of 32. Every pilot here has seen the nylon webbing that is strung across the runway and also the large red bull's-eye that is held aloft by this webbing. When the decision is made to use this barrier. we say, "Hit it in the center. That's what the bull's-eye is for. Remember the barrier is a big league catcher, so use it like a big leaguer would."



Just like a catcher's mitt, this bull's eye serves as a possible target for troubled jets.

This barrier is 300 feet long and has never been needed since it was installed. Do you have any information of engagements by barriers of this length?

Flying Safety Officer
Craig AFB, Alabama

Any Robin Hoods? Believe this gimmick is one of the best that has crossed our desk in many a moon. It is important to hit the center of the barrier. We have on record only one engagement of a 300-foot barrier. At Eglin AFB, an F-84F, traveling at 15 knots, stopped successfully.

★ ★ ★

Is Rex Real?

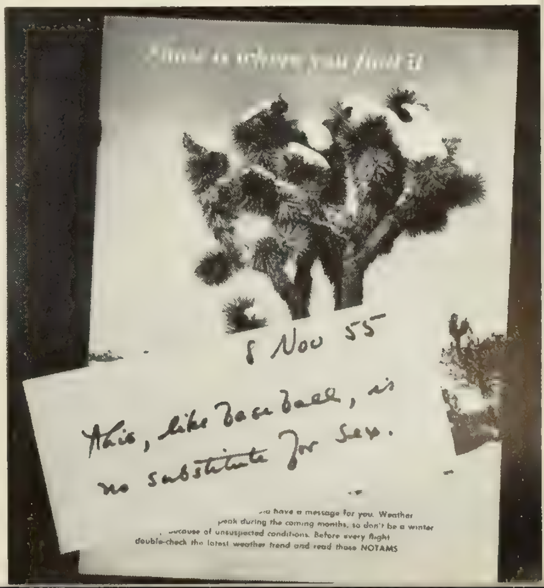
I am writing in hopes you can settle an argument for me. A friend and I were discussing your magazine when a question came up concerning the articles under the name of Major Rex Riley. I maintain that the Major is a real person, who is an accident investigator and writes articles for your magazine on such accidents.

My friend argues that he is fictitious and is only a name used in the illustration of accidents reviewed by FLYING SAFETY.

T/Sgt William Rodak, Jr.
33d Fld. Maint. Sq.
Otis AFB, Mass.

We have tried to make Rex as close to a real-life character as possible. The tipoff is in his name which could be spelled W-R-E-C-K-S. However, you're not in the minority, as we get quite a bit of correspondence addressed to the good major. Also, hope that we're not costing you any money.

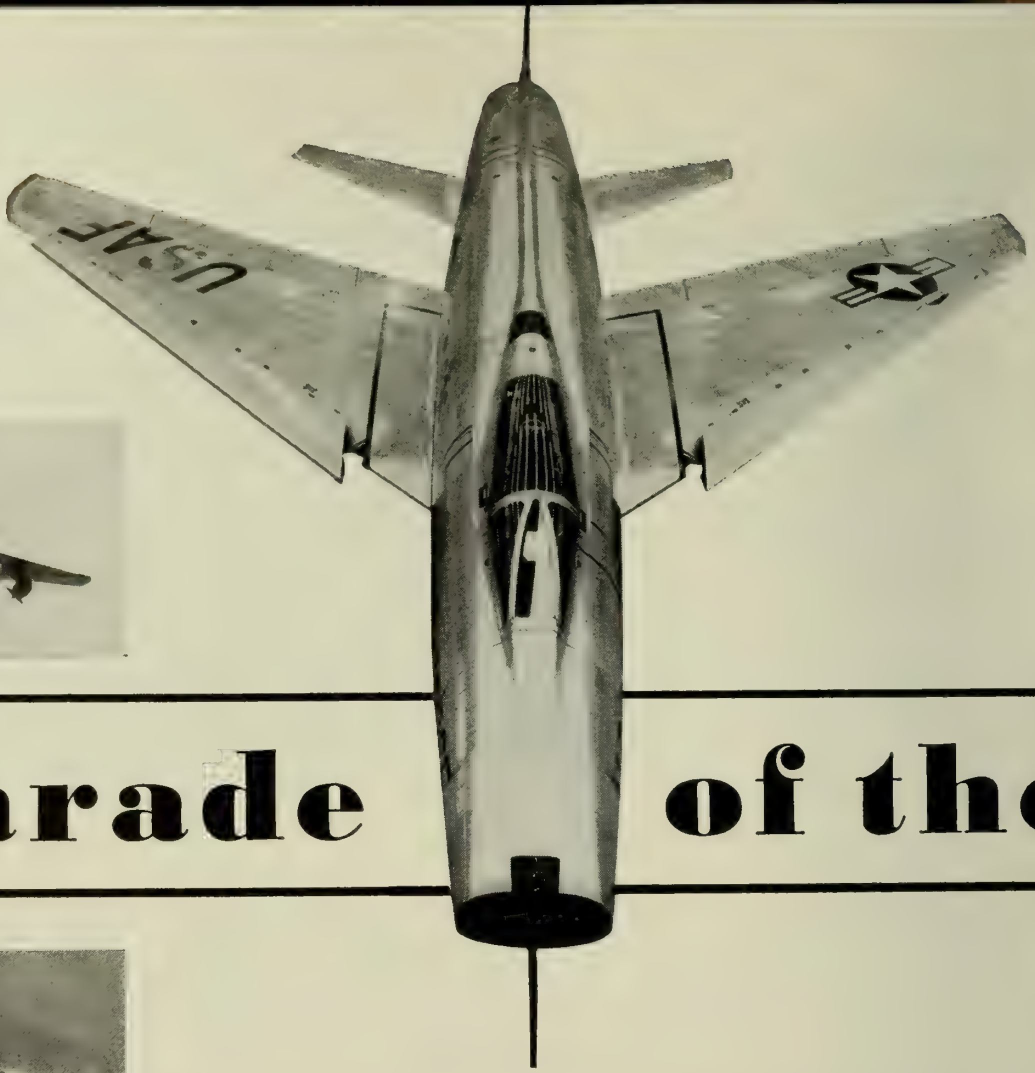
An anonymous reader sent this little gem which is pasted over the inside back cover of the November issue of FLYING SAFETY. Like the original, it speaks for itself.



8 Nov 55

This, like baseball, is no substitute for Sex.

...o have a message for you. Weather
...eak during the coming months, so don't be a winter
... because of unsuspected conditions. Before every flight
double-check the latest weather trend and read those NOTAMS



Parade of the

To keep you up-to-date, FLYING SAFETY will take you through the Century series aircraft. Articles on specific flying characteristics of the F-101 and F-102 will appear in future issues. Here are three features on the F-100 prepared by North American Aviation test pilots. They cover flying with external stores, flameout landings and some interesting information on the yaw and pitch damper installation on the first operational Century.

External Stores

Al White, Engineering Test Pilot

YOUR FIRST THOUGHT when you see the sleek, new F-100C is that here is a real fighter airplane, one of the fastest in the world. However, it is also a fighter bomber and is able to carry a variety of stores. Its six pylon stations give it a tremendous load-carrying potential. It has been tested at supersonic speeds carrying more than twice the bomb load of a World War II heavy bomber.

Still, being saddled with a load of stores is not the most desirable flight condition. It's like taking your future mother-in-law along on a date with your one-and-only. It slows you down, reduces your maneuverability and makes your approaches more difficult. Combat aircraft are merely platforms for their ordnance. This fact compensates for any objections that may be raised about the general deterioration of performance and flight handling characteristics when stores are being carried.

What it boils down to is that you *must* carry stores. Therefore, you should know the handling characteristics under these conditions.

Longitudinal Stability

First, let's find out how carrying stores affects longitudinal stability. Consider a clean F-100C trimmed in straight and level flight at a given airspeed and altitude. Now, suppose a gust load pitches the nose of the airplane up, causing an increase in angle

F-100 Centuries

of attack. Since lift varies with angle of attack, the lift forces on the tail and the wing will both increase; however, the increase in tail lift force acting on a relatively long lever arm provides a larger pitching moment than the pitching moment from the wing (wing lift times its lever arm). The resultant unbalanced pitching moment then tends to return the airplane to the original angle of attack. This is known as positive longitudinal stability. For this specific case, the amount of unbalanced pitching moment created by the tail for a given change in angle of attack determines stability. In general, longitudinal stability is a measure of the unbalanced pitching moment for a given change in lift. (See Figure 1.)

Now, let's exchange the clean airplane for one with stores under the wings. It is flying at the same speed and altitude and encounters a similar gust which causes the same change in angle of attack. This time, the lift force at the tail is less because of the effects of the change in the downwash angle and the turbulent wake behind the stores, together with forces on the store which are forward of the airplane center of gravity. Consequently, for a given change in angle of attack, the unbalanced pitching moment is less than in the case of the clean airplane. (See Figure 2.) The longitudinal stability is slightly decreased. This does not mean that the airplane is not stable.

You will notice this slightly decreased stability as a sluggishness of the airplane in returning to the trim condition when disturbed. Your normal reaction is to move the controls to help the airplane to return to a trim condition, and this means that you are working slightly harder than normal at flying the airplane. This is one reason why it is more difficult to handle an airplane with stores than a clean airplane.

Directional Stability

The effect that the installation of stores has on directional stability depends largely on where the stores are mounted. Stores mounted so that the greatest portion or all of the lateral flat plate area is forward of the center of gravity are de-stabilizing. (The lateral flat plate area is the area that is seen when the airplane is viewed in profile.)

The airplane gains directional stability from the vertical stabilizer in much the same manner as it gains longitudinal stability from the horizontal stabilizer. This directional stability is a function of the area of the vertical stabilizer. When stores are mounted forward of the center of gravity of the airplane, the lateral flat plate area of these stores cancels some of the effect of the vertical stabilizer. Therefore, the airplane has less directional stability.

You will be aware of this decrease in stability as a loss in some of the directional stiffness of the airplane. The airplane is more easily disturbed directionally, and it returns to the trim condition at a slower rate than

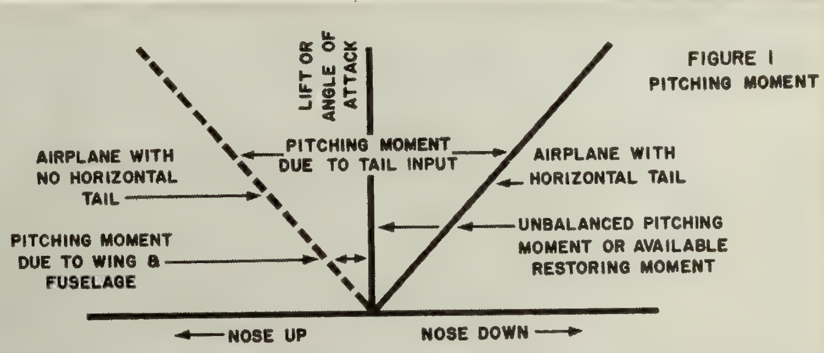


FIGURE 1
PITCHING MOMENT

LIFT OR ANGLE OF ATTACK
AIRPLANE WITH NO HORIZONTAL TAIL
PITCHING MOMENT DUE TO TAIL INPUT
AIRPLANE WITH HORIZONTAL TAIL
UNBALANCED PITCHING MOMENT OR AVAILABLE RESTORING MOMENT
PITCHING MOMENT DUE TO WING & FUSELAGE
NOSE UP
NOSE DOWN

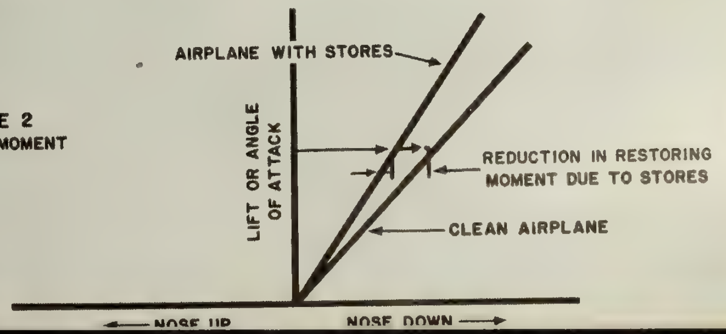


FIGURE 2
PITCHING MOMENT

a clean airplane. If you help the airplane maintain zero yaw with the rudder pedals, you will find that the airplane is easier to overcontrol directionally. Because of the lack of directional stiffness, it takes less rudder to push out against the effect of the vertical stabilizer. Directional stability has deteriorated slightly. This again must not be construed to mean that the airplane does not have directional stability. It is just slightly less stable than the clean airplane.

Lateral Stability

The installation of stores on the F-100C has little effect on lateral stability and reduces aileron effectiveness only slightly. Nevertheless, you will experience a slight reduction in lateral controllability. This is because of the inertia effects of the stores.

The maximum roll rate obtained at any given aileron deflection will be approximately the same with or without stores, but it will take longer to reach this roll rate with stores because of the mass that has to be set into motion. Similarly, it is more difficult to roll the airplane to a desired bank angle and then to stop exactly on this bank angle.

As an example of this effect, imagine that you are rolling a table on large casters across a smooth floor and you desire to stop the table on an exact spot. Normally, this is very easily done. Now place a heavy weight on the table. The table is more difficult to set into motion and more difficult to stop on an exact spot. This is much the same effect that you will encounter in trying to roll the airplane with heavy stores on the wings. The accuracy of your lateral control has been slightly decreased.

Al White is a graduate of the University of California, where he received his Bachelor of Science degree in mechanical engineering. During World War II, he flew F-51s and from 1948 to 1954 served as an engineering test pilot at Edwards AFB, California. Since 1954, he has been a test pilot at North American Aviation, principally testing F-100 airplanes.

★

Unsymmetrical Store Loading

Up to this point, we have assumed that the stores were mounted symmetrically on the airplane. However, a general discussion of handling characteristics on the F-100C with stores installed would not be complete without some explanation of the characteristics encountered with unsymmetrical store loading.

Let's consider handling characteristics with one store mounted under the left wing of the airplane and nothing under the right wing. It is obvious that right aileron will be required to balance the load of the store hanging under the left wing. The amount of aileron required depends on airspeed, store weight, aerodynamic effect of the store, and to some extent aileron efficiency, which is decreased. The aerodynamic yawing moment of this deflected aileron varies with Mach number as does the yawing caused by the drag of the store.

The curves in Figure 3 show these yawing moments due to deflected ailerons and the drag of the store under the left wing.

The yawing moments of the store and the aileron (Figure 3) are equal (and of opposite sign) at three points in the normal speed range of the airplane. This means that at these three points no unbalanced yawing moments exist. Consequently, zero trim is required to hold zero yaw.

Figure 4 shows the rudder required to maintain zero yaw as plotted against Mach number, and corresponds to the rudder necessary to correct for the unbalanced yawing moments shown in Figure 3. There are three points within the speed range of the airplane where zero rudder is required. They correspond to the three points where the yawing moment of the store and aileron are equal.

In the center of the curve in Figure 4, there is one small speed range within which the yawing moment from the deflected aileron is greater than that due to the drag on the store. In this speed range, left rudder is required to maintain zero yaw with the store hanging under the left wing. At very high Mach numbers, the yawing moment from the aileron again is greater than that of the store, and again left rudder is required.

In flying with an unsymmetrical store loading, the amount of rudder available is of utmost importance. The actual amount of rudder available is dependent upon the indicated airspeed at which you are flying.

For example, rudder available at 15,000 feet is less than that available at 35,000 feet. Therefore, although zero yaw cannot be maintained at Mach numbers slightly above .96 Mach at 15,000 feet, supersonic speeds at 30,000 feet and above are possible without yaw.

It would be possible to dive from a high altitude at maximum power

The six pylon stations on the supersonic F-100 give it a tremendous load-carrying potential.

FIGURE 3

MOMENT CURVES YAWING

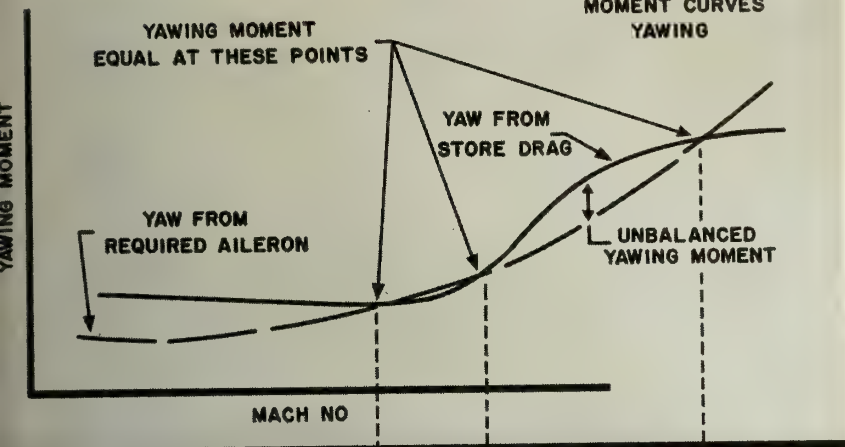
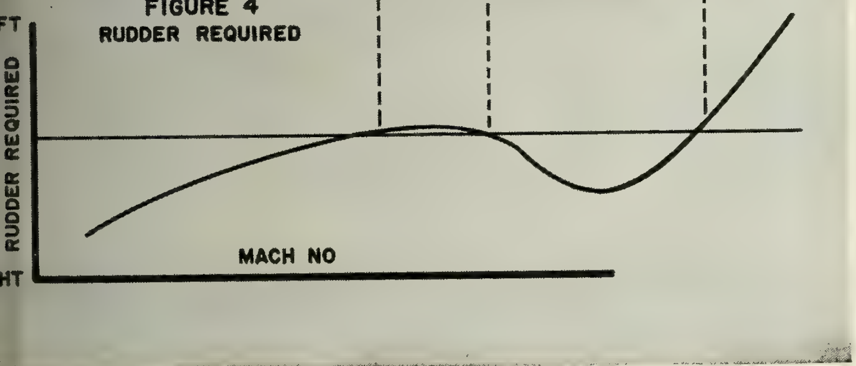


FIGURE 4

RUDDER REQUIRED



and arrive at a lower altitude (such as 15,000 feet) at a supersonic speed where the yawing moments from the aileron and store were well enough balanced to allow directional control. However, in this type of maneuver, the airplane cannot maintain its speed at 15,000 feet after the pullout is made. It would decelerate through the range where the rudder required to maintain zero yaw is greater than the rudder available. As a result, the airplane would yaw in spite of full rudder application against it, but large yaw angles would not be encountered.

When the airplane is dived from high altitudes, the dive should be accomplished at reduced power, and Mach restrictions for the particular configuration being flown should be observed. Adequate control is available as long as the Mach restrictions are observed.

With a symmetrical load, the takeoff characteristics are the same as those of the clean airplane, except that more runway and a higher lift-off speed are required. However, unsymmetrical external loading requires a slightly different technique. The added friction due to increased load on one main landing gear, together with the aerodynamic drag on the store, causes the airplane to yaw toward the heavier side.

Rudder power alone is not sufficient to maintain zero yaw below 130 knots. Therefore, nosewheel steering should be used to a minimum of 130 knots. When nosewheel steering is disengaged, you should be prepared to apply three-fourths to full rudder, immediately. This technique keeps the airplane straight on the runway.

Nosewheel lift-off should be accomplished at a maximum of 150 knots, regardless of airplane lift-off speed, in order to avoid excessive vibration. Handbook performance charts always should be consulted for takeoff distances and recommended lift-off speeds, taking into account, of course, the runway pressure altitude, runway temperature and airplane gross weight.

Afterburner and Speed Brake

Lighting the afterburner with stores under the wings causes the airplane to pitch nose-down slightly. This occurs because the vertical position of the center of gravity is lower than the axis of thrust. The sudden surge of power on an axis above the center of gravity causes a slight nose-down pitching moment.

Similarly, a slight pitch-up is encountered when coming out of afterburner. This phenomenon is particularly noticeable at low altitudes where the afterburner gives a greater increase in thrust.

Whenever stores are installed on the pylons at the two inboard stations, lowering the speed brake causes the airplane to pitch up. The speed brake is lowered in a channel between these pylons, and the air is somewhat restricted from passing around the sides of the brake. More air is forced down, and since the speed brake is forward of the center of gravity, the resultant force on the airplane is nose up. The intensity of the pitch-up increases with indicated airspeed.

If only one pylon (with or without store) is installed and the speed brake is lowered, the airplane yaws toward this pylon. The air passing around the side of the brake strikes against the pylon, and since this pylon is ahead of the center of gravity, the airplane naturally yaws in the direction of the pylon.

If this maneuver is accomplished with the controls free, the airplane pitches up very slightly and yaws and rolls toward the pylon. However, the roll is due to the yaw. The predominant trim change is yaw, and again the intensity depends on the indicated airspeed.

The shapes of stores are improving and as a result will not detract from the performance and stability of high-speed airplanes as much as some of the present-day low-speed stores.

Our purpose in this article is to give you a better understanding of the F-100C characteristics, believing you will be more tolerant of the handicaps imposed by the installation of stores and better prepared to use the airplane to the utmost of its flying capabilities. ●

Emergency Landings

Bob Baker, Chief Engineering Test Pilot

Bob Baker began his flying career in 1939 while studying Aeronautical Engineering at Rensselaer Polytechnic Institute in New York. After graduation, he flew engineering test flights for Curtiss-Wright and the National Advisory Committee for Aeronautics. He is currently chief engineering test pilot for North American Aviation and is actively engaged in testing the F-100A and C aircraft.

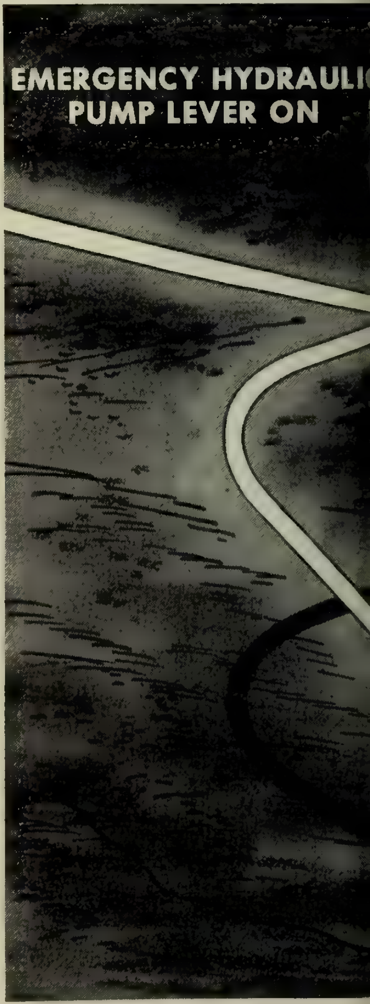
ONE THING IS SURE—just about two minutes after you pass through the high key altitude in your F-100, you'll be on the deck. Just where on the deck depends on you; your knowledge of your aircraft's handling qualities, whether you have a plan and how much you have practiced. The plan for a forced landing is shown in Figure 5. Arriving at this plan wasn't simple, and to make it work requires knowledge of its derivations and limitations, and then plenty of practice.

An emergency landing to the casual reader of the Flight Handbook is a simple operation when depicted on paper. However, as every pilot knows, the actual procedure is not quite as simple as it looks. The figures and patterns shown on the illustration have a lot of hidden meaning and require considerable practice before they are useful to an F-100 pilot.

Glide Speed

Of primary interest in the F-100A and C forced landing pattern is the manner in which the glide speed of 220 knots IAS was selected. Both airplanes are equipped with irreversible hydraulically actuated controls which power the flying tail, ailerons and rudder. Power to the controls is being supplied by two engine-driven pumps. A ram-air turbine is provided to supply hydraulic power to one of the control systems for use during forced landing when the engine is windmilling and the pumps' output is low, or in an extreme case, when the engine is "frozen" rendering the normal hydraulic pumps inoperative.

The hydraulic power available from this source increases as the speed of the airplane increases. At the minimum touchdown speed of the airplane, pump output is decreased, while the amount of hydraulic power required for control movement at this speed is increased. Since the flight controls demand hydraulic power from the single available supply, it is wise to limit unnecessary control movement as much as possible during the approach. This will ensure that hydraulic power will be at a maximum for control movement needed during the flareout and touchdown. As a result of actual simulated forced landings and a study of their requirements, 220 knots IAS was selected as the best approach speed. It provides satisfactory airplane handling char-



acteristics and at the same time provides a good supply of hydraulic pressure and flow.

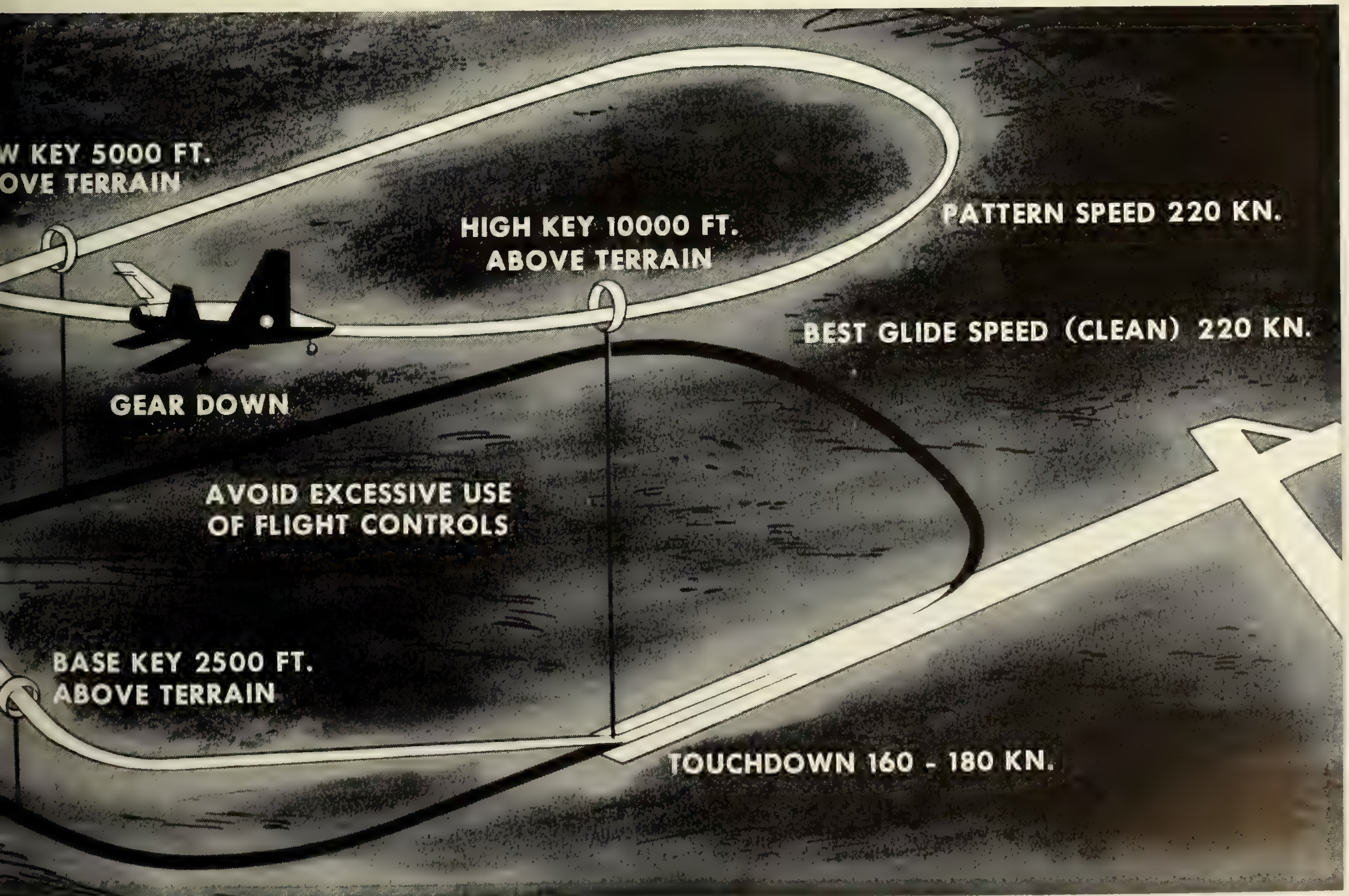
Referring to Figure 5 again, we have now established a glide at 220 knots and maintain this airspeed until after the turn on final. Completing the final turn, we find that less control movement is required and that we can safely drop our speed to 200 knots on final approach. Touchdown speeds are listed as below 180 knots because that is the maximum design speed for the drag parachute. Although touchdown at speeds as low as 150 knots can be made successfully, rough air or crosswind conditions could require more than normal use of the ailerons. This might reduce the available supply of fluid and limit control movement at this critical time. To be on the safe side, keep your touchdown speed above the 160 knot minimum.

The purpose of the key altitudes shown in the illustration is to give you a reference to shoot for and also an idea of how well your pattern is coming. The high key is over the landing line and just to the right of the runway before the first 180-degree turn on the downwind. Low key is ON downwind and opposite the landing spot before the 90-degree turn onto the base leg. Base key is a term coined here to replace the longer phrase "altitude at base leg" and is just before turning 90 degrees onto the final. If you are fortunate enough to be able to start at the high key altitude, you can tell when approaching the low key altitude whether your pattern is too tight or too wide. If you are higher than you should be at low key point, you know that you are underestimating the ability of the airplane to glide a given distance, and must extend your downwind leg. If you are low at the low key point, you know you must cut your pattern short in order to make the runway. Two check points are provided in the low key and base key from a high key entry; however, if you do not have sufficient altitude to enter the pattern at the high key, you enter at the highest key altitude available to you. This may be low key or even base key, if you are caught at low altitude. Leaving the landing gear up until a key altitude has been attained increases the distance available. Conversely, if over the field above high key, the landing gear may be lowered at any time desired.

The forced landing diagram shows the landing gear down at the high key. Actually, the landing gear can be extended at any time the airplane is over the field. It is suggested that the landing gear be down at the high key so that the glide path can be well established and other variables will not be introduced at some point in the pattern, causing higher drag and resulting in miscalculation of the touchdown point. The cleaner the airplane, the farther it will glide; therefore, speed brakes are retracted throughout the pattern.

The speed brake operates from the utility hydraulic pressure system, which also supplies power to the wheel brakes. Any use of the speed brake reduces reserve power for wheel

Fig. 5. Key altitudes will give you a reference to shoot at and a good idea of your pattern.



". . . just about two minutes after you pass through the high key, you'll be on the deck."

brakes. This does not mean the speed brake cannot be used, because a windmilling engine will provide a continuous, although lower than normal, hydraulic pressure supply. Actually, the use of the speed brake is not too desirable from an aerodynamic standpoint. The rate of descent of the airplane with gear down and speed brake in requires a glide speed of 190 to 200 knots IAS to provide sufficient energy to flare the airplane (allowing a slight margin for error in starting the flare).

Flare Speed

Flare speed would dictate approach speeds if the hydraulic requirements had not been slightly higher. The higher rates of descent from speed brake extension would reduce glide distance, increase difficulty of flare judgment, and put larger demands on the ram-air turbine hydraulic supply. When the flare has progressed to where a landing is ensured, the speed brake could be extended to reduce speed and glide distance; however, there is still the possibility of reducing wheel brake pressure. Wheel brake pressure will mean more in reducing the landing roll than opening the speed brake at that low airspeed.

Your perception as to where you will actually contact the runway is not possible until you are on the staight-away final approach. As you accumulate more F-100 flying experience, you'll find that you can judge more accurately your point of touchdown. Actually, there is an explanation for this increased proficiency. This explanation is most obvious at night when the runway has contact marker lights. As you approach the runway and the contact lights appear to hold the same position relative to each other, you are coming in at a constant angle and will make the runway. If the runway contact lights begin to get farther and farther apart, it means the glide is high and you will fly over the runway. The lights, of course, will reach the maximum distance apart when you are directly over them. If the lights come closer together approaching a point, the glide is getting too low and you know you will undershoot. During daylight operations, you can pick up runway length, buildings and many other objects to give you a clue as to whether your approach will be long, short or just right.

Simulated Flameout

Practice forced landings can be made if you set up the glide angle you will encounter in an emergency landing. Flight tests have shown that a windmilling engine with speed brake in, produces the same drag on an airplane as an engine running at approximately 80 per cent with the speed brake out. Practice forced landings should be made, keeping as many variables as constant as possible. The key altitudes given here are the minimum altitudes at which it would be desirable to attempt the pattern. You should practice emergency landings by gliding at 220 knots IAS in the pattern, slowing to 200 on the final approach and to 180 during the flare at the end of the runway, aiming for

Touchdown speeds are listed as below 180 knots because that is maximum design for drag chute.

the first third point of the runway. Use the same key altitudes, 10,000 feet for the high key, 5000 feet at the low key and 2500 feet at the base key added to your field elevation. Pick round numbers. If your field is 2410 feet, fly your base at 5000, indicated. Vary your actual path over the ground so as to correct for any deviation from these key altitudes. As every landing is apt to have different wind conditions, you must make your turns closer to the field and farther upwind as the wind increases.

During the approach for an emergency landing, you should monitor flight control hydraulic system number one, as the emergency ram-air turbine is on this system. If the speed brake is used on final approach to slow speed to make contact with the first third of the runway, you must remember that utility pressure is being taken away that would have been available for brakes. Upon contact with the ground, you should switch to the utility pressure system so that you will have an idea of how much braking power is available. As long as the utility pressure stays above 1000 psi, you can apply brakes in the normal manner. If pressure drops below 1000 psi, you should use brakes with extreme caution, as you will soon be going onto the emergency accumulators.* In this case, you should apply a slow and steady pressure in an attempt to provide braking without skidding the wheels and blowing a tire. When utility hydraulic pressure fails, the nose-wheel steering fails and emergency gear retraction is not possible. Avoid excessive use of controls, especially ailerons, in order to conserve the available hydraulic flow on the ram-air turbine.

Power-off landings aren't easy, but F-100 pilots have made successful dead-stick landings. My helmet goes off to those pilots because they have developed that touch that makes a man a part of his airplane. That pilot touch comes from having a plan and practicing to make it perfect. ●

**F-100C airplanes AF54-1915 and subsequent have an added feature in the brake system which allows you to use brake pedals to pump up and apply pressure manually after the emergency accumulator pressure has been depleted. Braking action then will depend on the amount of pressure that you can apply manually to the brake pedals.*

★ ★ ★

Yaw and Pitch Dampers

Bob Baker
Chief Engineering Test Pilot

A GOOD AIRPLANE should have dynamic and static stability. This means that with a constant power setting and the airplane trimmed for level flight, the controls can be momentarily disturbed and the airplane will regain its original attitude.

Kicking the rudder causes a directional oscillation which gradually decreases in magnitude, and the airplane returns to its trimmed position. How quickly the oscillations diminish is the measure of aerodynamic directional damping. The amount of damping depends largely on air density and air-speed. To supplement aerodynamic damping, particularly under high-altitude conditions, the yaw damper is used on the F-100 series.

The yaw damper system uses a gyro to sense yaw rate and create signals which are amplified, varied in intensity according to altitude, and used to control the position of the yaw damper hydraulic actuator. This actuator operates the control valve of the rudder hydraulic actuator to deflect the rudder and automatically correct the directional oscillations of the airplane nose. It should be noted that only changes in yaw rate affect the system. All steady rate signals, such as encountered in a normal turn, are washed out by the system amplifier.

The yaw damper does not increase the static directional stability of the airplane but does supplement the aerodynamic damping of directional oscillations.

We made flight tests at North American to determine how much rudder displacement was required from a given electrical signal received from the gyro. The entire speed range and altitude capabilities of the airplane were checked for yaw damping, and signal inputs made to vary with altitude. From these tests we selected the requirements used for flight checking production airplanes before delivery. Air Force pilots can flight test their airplanes in the same manner. Here's how it goes:

With the airplane trimmed for straight-and-level flight in military power at 35,000 feet, sideslip the airplane, keeping turn needle centered and the ball one ball-width out of center. Release controls abruptly and count the number of times the turn needle passes through zero rate of turn. With the yaw damper switch in STANDBY, the needle will pass through center five to 10 times before its motion is so small that it cannot be counted. Each time the needle passes through center, one-half cycle has been completed. In other words, five counts would be 2½ cycles.

Now, with the airplane still trimmed for straight-and-level flight, the yaw damper switch is turned to ON. There should be no change in trim due to the yaw damper being on. Repeat the side-slip, keeping the turn needle centered and the ball one ball-width out of center. Release controls abruptly and observe the turn needle. If the yaw damper is set properly, the turn needle will pass through center not more than four times (following the initial deflection), indicating that damping is completed in two cycles or less.

Yaw dampers installed in production airplanes have three gain settings (high, nominal and low) which control the amount of damping action. These settings are adjustable only from the ground. If the gain setting is too high, needle action is sluggish and does not pass through center even once. If you happen to be "sitting on the perch" for a high side pass at a target and the gain setting is too high, as soon as you use aileron to start your pass, the nose will hang up and the airplane will be felt to slip in the direction of the turn. Perhaps you're making shallow turns to clear an area and notice the nose tends to yaw away from the direction of the desired turn. This also is an indication of high gain setting. If the gain setting is too low, the needle will oscillate from five to 10 times before damping. In either case, the yaw damper should be rechecked with ground measurements, in accordance with applicable tech orders to give the proper damping action. This is important.

Since the yaw damper serves no useful purpose during takeoff and landing and may cause objectionable heading changes under crosswind conditions, the yaw damper should be turned to STANDBY for all takeoffs and landings. Whenever terrain clearance is less than 3000 feet the yaw damper should be set to STANDBY. The natural aerodynamic damping of the airplane itself is very good at lower altitudes.

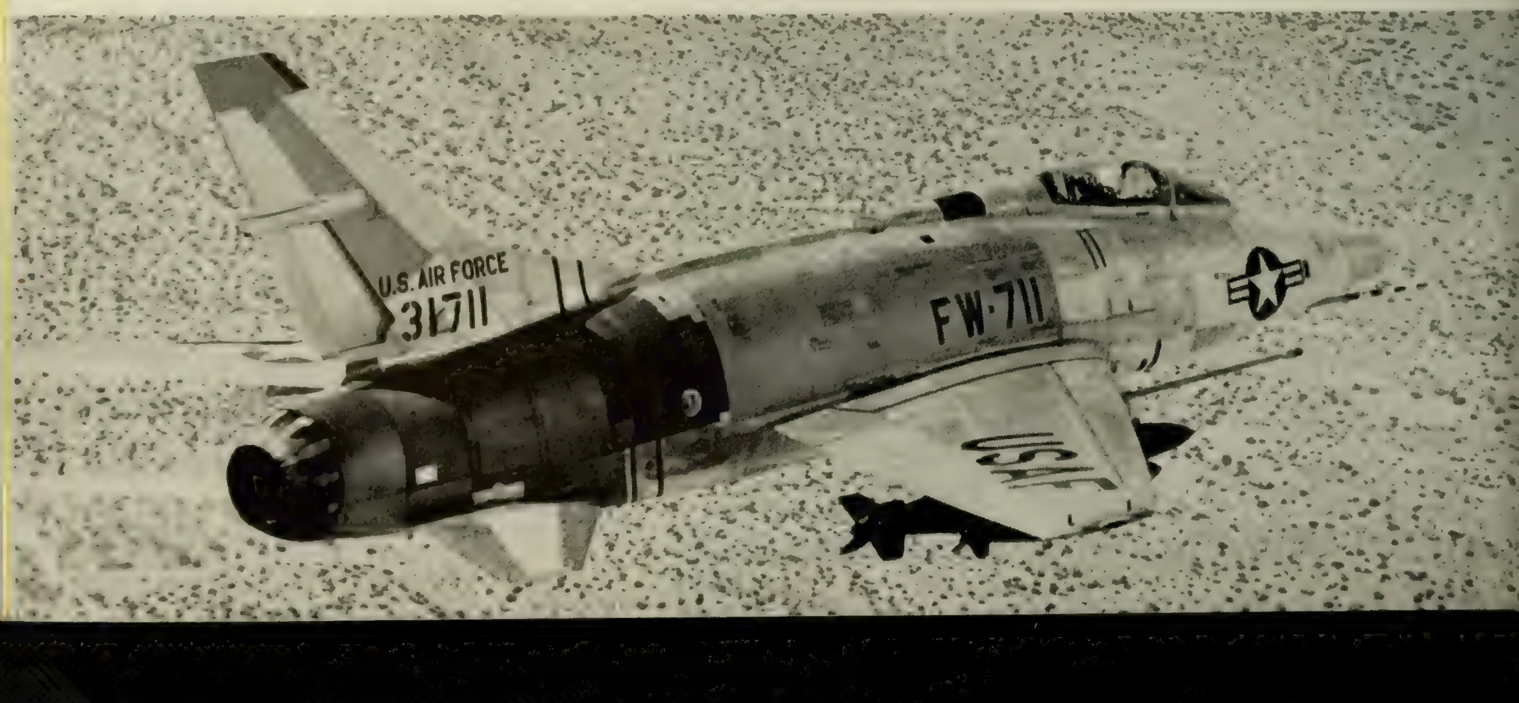
The yaw damper has fail-safety features which cause automatic shutoff to prevent malfunctions in the system from causing dangerous attitude changes of the airplane. Occasionally, however, malfunctions which are not dangerous but which prevent proper yaw damper performance may occur. In this case, place the system to STANDBY and have the ground crew check-out the yaw damper after landing. If the yaw damper should lock out because of a temporary inverter malfunction or loss of electrical power, it can be reset about 1¼ minutes after the malfunction has cleared by placing the yaw damper switch at STANDBY and then returning it to the ON position.

Having checked out the damper in your airplane, make a pass at an air target with the damper off and then turn it on and repeat the pass. Try this on a ground target in rough air. You can do a lot better job with a lot less work using the yaw damper. Watch those scores go up!

Pitch Damper

When flying in high, thin air, an aircraft loses some of the advantages of a denser atmosphere. One of these is natural aerodynamic damping. You have probably noticed the effects of reduced aerodynamic damping under certain flight conditions as a pitch oscillation when recovering from a

With constant power setting and trimmed for level flight, the F-100 has excellent stability.



turn or when pulling up to a target. While this oscillation is small in the F-100, it is noticeable enough to require your attention for satisfactory air-to-air tracking. This pitch oscillation also is too fast for a pilot to apply corrective pressure in the proper direction at the right time to damp the oscillation.

To solve this problem, North American Aviation came up with a pitch damper system. This system automatically corrects for oscillations much faster and more accurately than the pilot and helps provide an improved gun platform at high altitudes and high Mach numbers. Basically, it consists of a gyro that senses pitch motion and feeds this information to an amplifier. The amplifier controls a hydraulic actuator which is connected to the stabilizer control system. Only changes in pitch rates are transmitted as a signal to the pitch damper. Steady pitch rates as encountered in normal turning maneuvers are not transmitted.

The natural aerodynamic damping of the airplane is good at low altitudes. Use of the pitch damper is, therefore, not recommended for takeoffs and landings as it could cause objectionable airplane attitude changes. The damper switch should be depressed to the STANDBY position at all times when the airplane is less than 3000 feet above the terrain.

Since an aircraft loses some of its natural aerodynamic damping at high altitudes and has good damping in the denser air at low altitudes, the amount of automatic correction required from the pitch damper decreases with decreasing altitude. This is necessary to avoid overcorrection at low altitude. The pitch damper incorporates an automatic means for preventing overcorrection from occurring.

Here's the way we flight test the pitch damper system at North American Aviation:

Trim airplane for straight-and-level flight at 35,000 feet and military power. Pull up 500 feet, and then push over in a 10-degree dive. Make a 2 to 3G pull-up, raising the nose slightly above horizon; then release controls abruptly. With the pitch damper switch depressed to the STANDBY position, about three to five pitch oscillation cycles occur before the airplane damps to the trim attitude. In other words, the airplane's nose will cross a horizontal reference six to 10 times. With the pitch damper switch on, the airplane pitches down, overshooting the trim attitude once, and then comes back to rest at the original trim attitude. The purpose of the climb and dive is to ensure that airspeed is the trim airspeed, because straight pull-up would cause the airspeed to bleed off.

Another check of the pitch damper for satisfactory operation is simply depressing the damper switch to the STANDBY position and then pulling it back out. There should be no change in trim in either case.

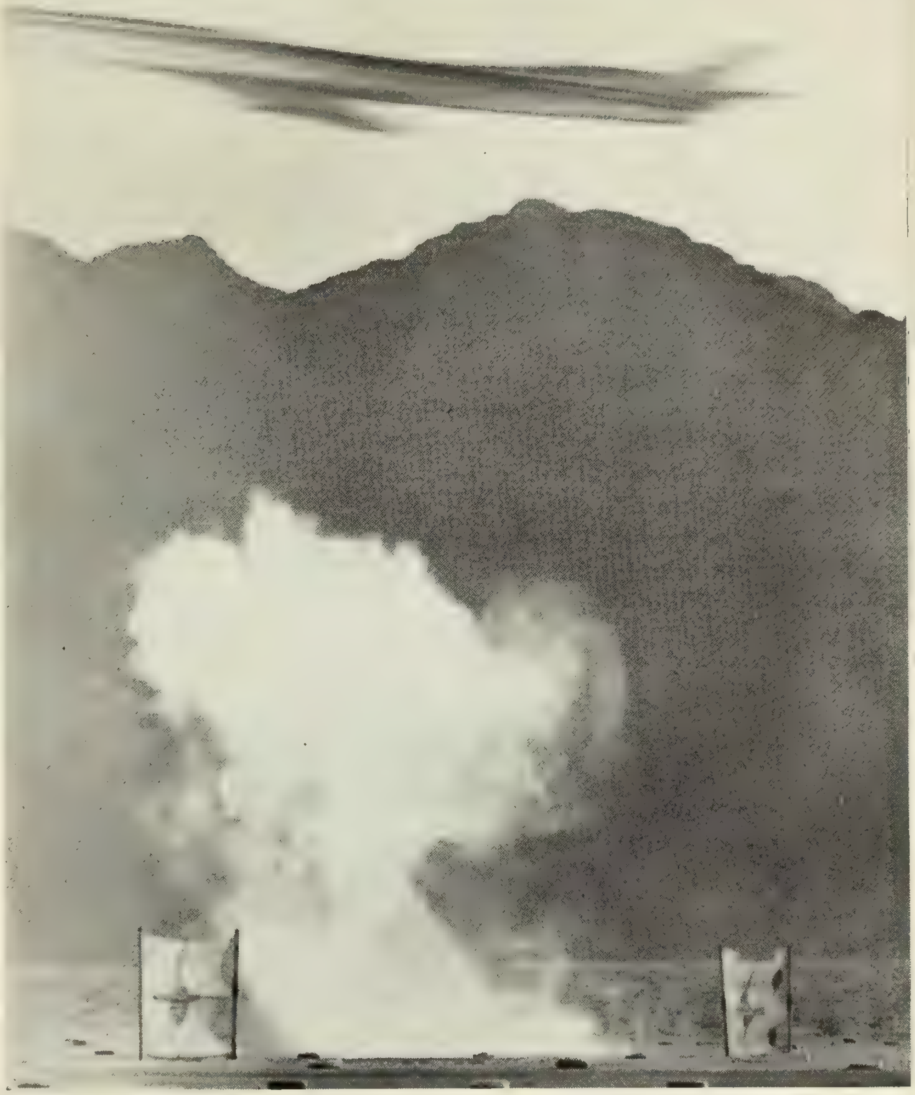
We have turned the pitch damper on in level flight and in turns pulling 2 to 3G, with no transient oscillations noted. We have kept the pitch damper on during all sorts of maneuvers, rolls, loops, Immelmanns and simulated combat without encountering any unsatisfactory or dangerous G conditions whatsoever.

There is a safety circuit in the pitch damper which limits deflection response to prevent unsatisfactory G conditions. If this safety circuit does not function correctly, the pitch damper is automatically shut off.

Occasionally, malfunctions which are not dangerous but which prevent proper pitch damper performance may occur. In this case, place the system in STANDBY and have it checked by the ground crew after landing.

If the pitch damper should lock out because of a temporary inverter malfunction or some other temporary electrical power failure, it can be reset about 1¼ minutes after the malfunction has cleared by depressing the pitch damper switch to the STANDBY position and then pulling the switch back out.

The pitch damper thus supplements the aerodynamic damping qualities of the F-100C, giving you a better gun platform and better tracking potential at high altitudes and airspeeds. ●

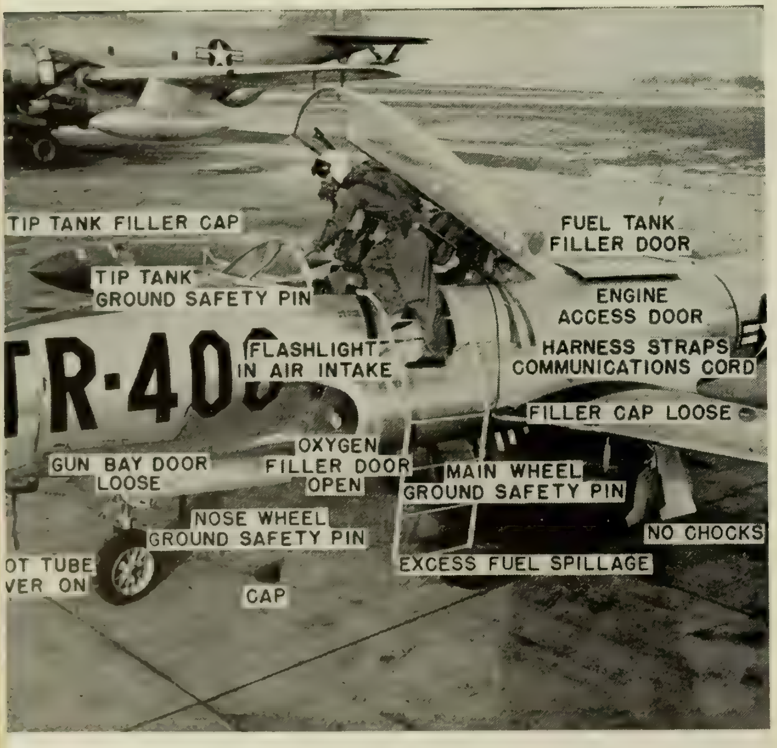


Watch those scores go up when you use the yaw damper. A better job with a lot less work.

Keep Current

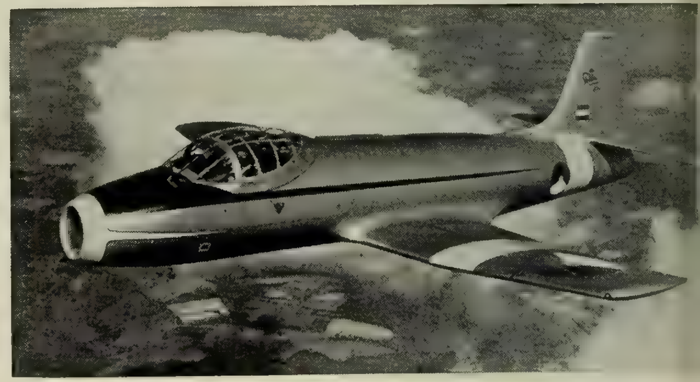
NEWS AND VIEWS

Fokker Jet Trainer—Due to start on a demonstration tour is the new Dutch-developed Fokker S-14 jet trainer. In the 450 miles per hour class, it has a wingspan of 39 feet and overall length of 44 feet. Its centrifugal flow gas turbine engine is rated at 3470 pounds of thrust and the aircraft takes off over a 50-foot obstacle in about 3300 feet and climbs at 3000 feet per minute. At 25,000 feet altitude, the plane has a maximum range of 600 miles without tiptanks. Fairchild holds manufacturing rights. ●



Here are the answers to the photo on page 1. Did you catch them?

Making its first powered flight recently is the X-2 rocket plane.



The Fokker jet trainer will make its debut shortly.

Calling All Cars—The development of an improved, miniature, lightweight emergency radio which permits a stranded airman to direct his own rescue has been announced recently by Hqs ARDC. The new radio weighs only 15 ounces.

This combination transmitter and receiver will be included in the standard survival kits for aircrews. Because of its size, it will be especially adaptable for fighter pilots.

Containing sub-miniature tubes and cell batteries, this radio will transmit from 50 to 100 miles. Following a forced landing or bailout, the pilot need only push the transmitter button and broadcast information regarding the crash and his location. If he wishes, he can set the radio to broadcast a continuous tone signal which rescue aircraft can use to "fix" his position.

Two-way conversation may be carried on between the stranded airman and the rescue aircraft. The UHF voice and tone signals are broadcast on an established emergency frequency. ●

★ ★ ★

Flying Research Lab—The first powered flight of the X-2 rocket plane has been made at Edwards AFB, California. It was flown to "transonic speed" by Lt. Col. Frank Everest, chief test pilot.

Designed specifically to probe the so-called thermal barrier, the X-2 will be used solely as a flying research laboratory. It incorporates many innovations, among them the use of stainless steel and K-monel in the fuselage and wings. Both these metals have a much higher melting point than aluminum which softens and loses much of its strength at high temperatures.

It is powered by a rocket engine capable of developing power almost equal to that which is developed by a modern Navy cruiser.

The cabin is heavily insulated, pressurized and detachable. Should a pilot have to leave the X-2 at high altitudes, explosive charges would separate the entire cabin from the rest of the airplane. A ribbon type parachute would carry the capsule to a low altitude where the pilot could then parachute to the ground.

The windshield is made of highly tempered glass capable of withstanding almost 1000 degrees Fahrenheit. It also will resist infra-red rays. This is a necessity, for at the altitudes that the X-2 is designed to reach there are no dust particles to cut down the intensity of the sun's powerful rays.

A B-50 bomber has been adapted to carry the X-2 to altitude from which it begins its flight. ●

★ ★ ★

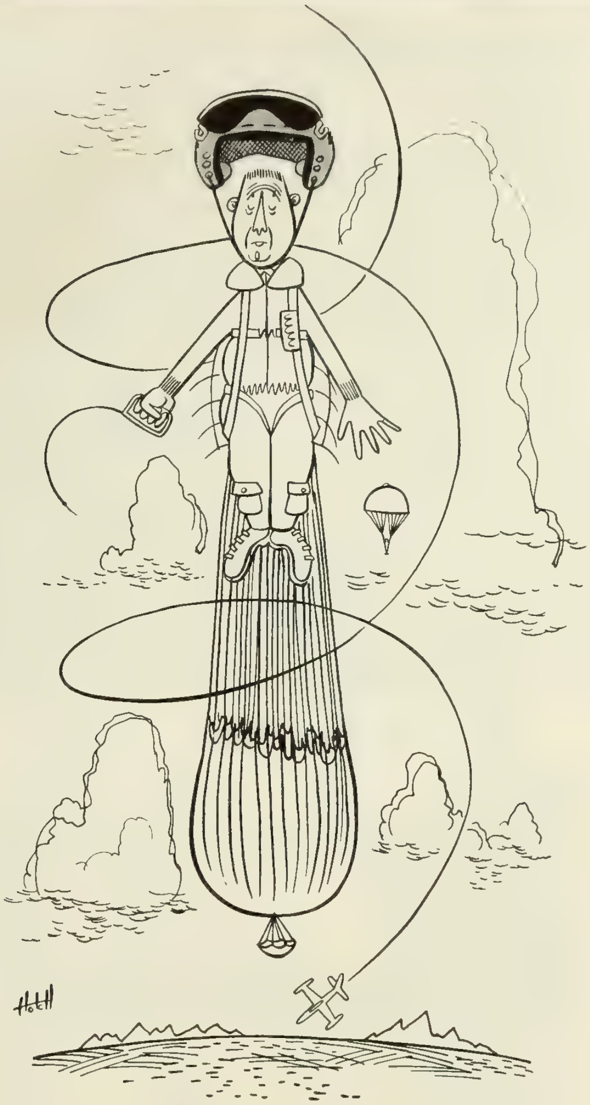
Sixteen Tons—The world's largest turbine-powered transport helicopter—the 40 passenger Piasecki YH-16A "Turbo Transporter" made its public debut recently.

The YH-16A is powered by two YT-38 gas turbine engines whose power is harnessed to turn the two giant, powerful rotors.

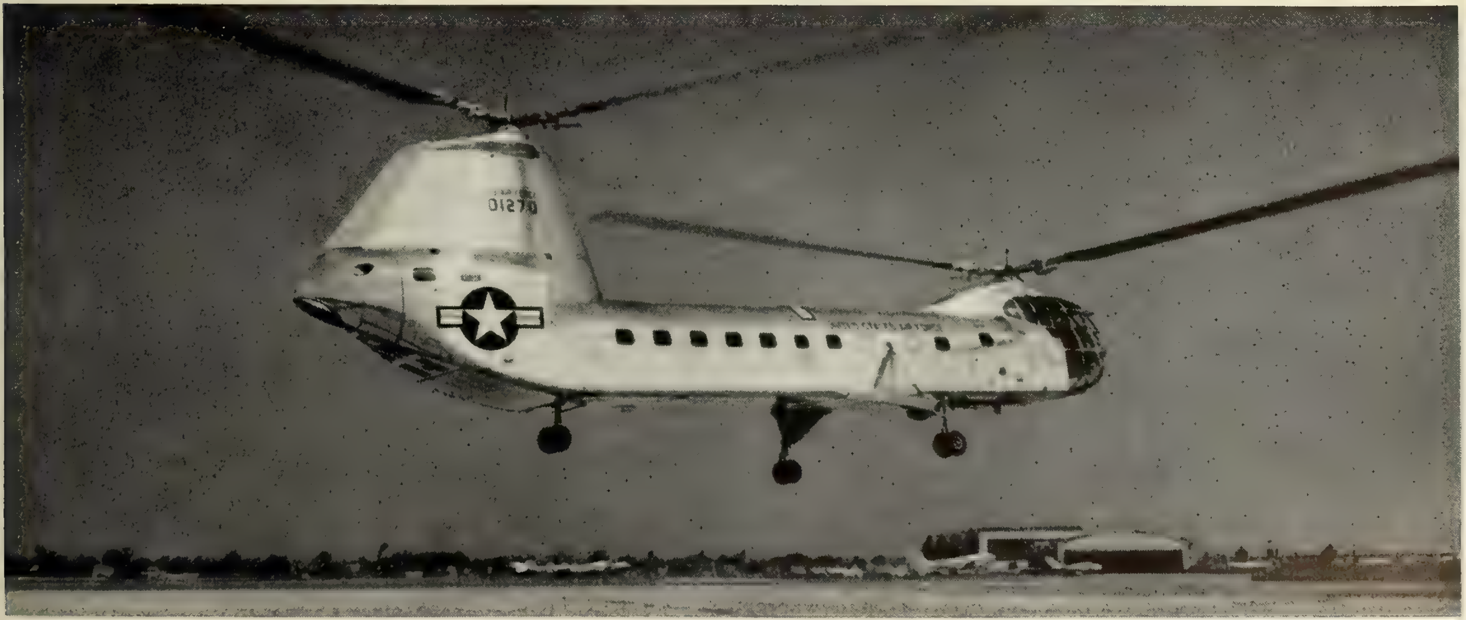
This helicopter weighs over 16 tons and has a top speed of approximately 150 miles per hour. Its fuselage is 77½ feet long and each of the three-blade tandem rotors measures 82 feet in diameter.

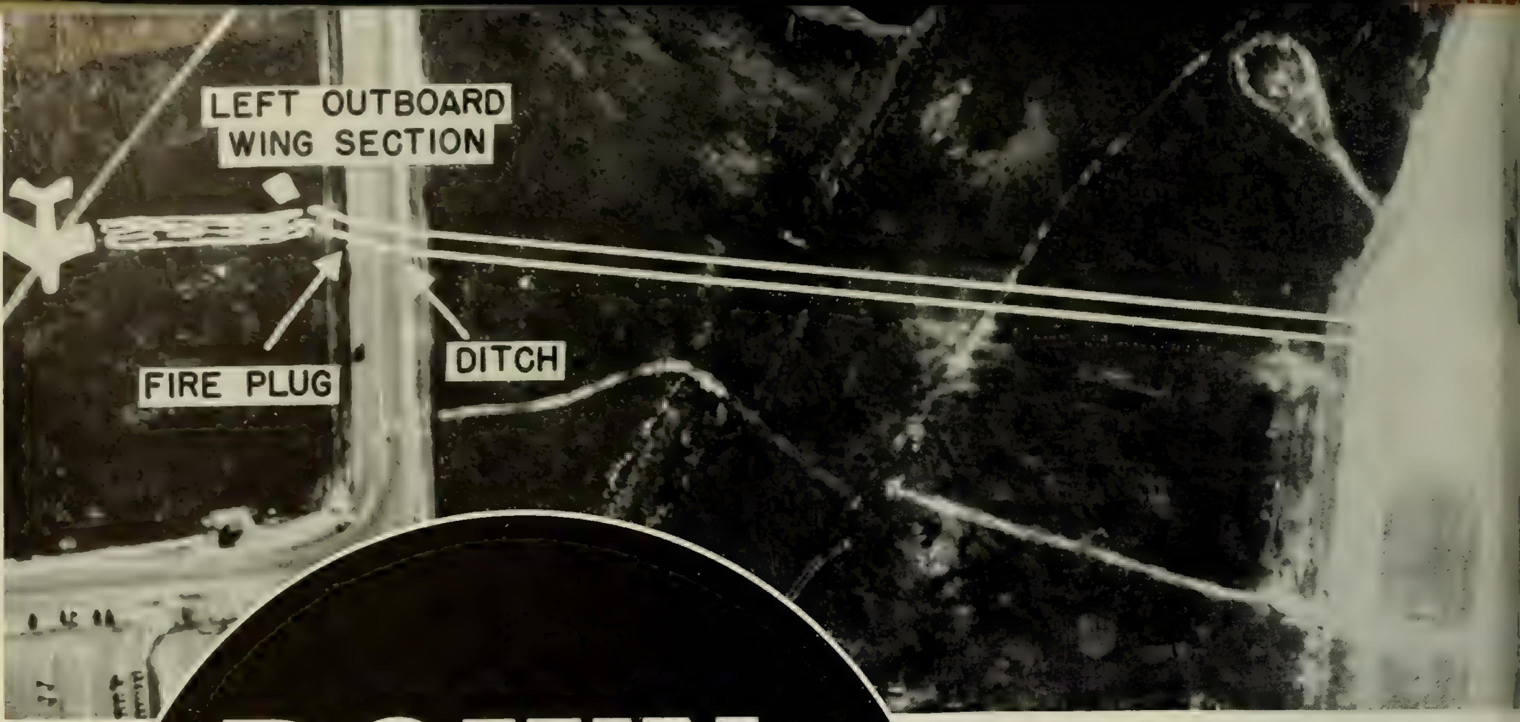
During flight tests, the aircraft demonstrated its ability to fly and maintain altitude, carrying a normal load with only one engine operating. In addition, its autorotative flight with both engines shut off is another advancement in flying safety.

The use of gas turbine engines in helicopters offers several important advantages over standard reciprocating engines. They are smaller and lighter, yet have the same power. They operate at optimum fuel consumption in the higher power ranges. They are easier to service and maintain. No ground warm-up time is required and the vibration and noise level is markedly lower. ●



Hovering effortlessly is the new YH-16A turbo transport helicopter.





Through brush, across an irrigation ditch, over a highway, into a fire plug, but still the pilot was uninjured. The gear was down.

DOWN, BOY, DOWN

Should you land gear-up or gear-down on an unprepared surface? Regardless of the type of aircraft that you fly, you should know the answer to this question. This article has the answer.

IF YOU ARE a jet fighter jockey. this story is for you. If you aren't a fighter type, I'd suggest you read it anyway. I think you'll be surprised!

The Dash One says, "If sufficient altitude is available, it is recommended that the crewmembers bail out in preference to ditching or crash landing, even if over open, flat country ——." But what happens when you are involved in a situation where you are too low or for some other reason have no option but to land?

To tell you that you are less susceptible to injury when you land a jet fighter with the gear down on an unprepared surface is one thing. To have you believe this new concept is another and, incidentally, the purpose of this article.

I was rather skeptical about this recommendation even after reading the study on it. However, I think that once you are familiar with the whys and wherefores, you will agree that emergency landings on unprepared surfaces should be accomplished gear down. As a result of this study, all fighter Flight Handbooks, excluding the one on the F-89,* are now being revised.

The study was made primarily because of the increasing frequency of spinal injuries sustained by pilots during wheels-up landings of modern jet fighter aircraft.

Originally (July, 1954), a committee headed by Dr. E. J. Baldes, of the Scientific Advisory Board, USAF, probed into the problem, and came up with some recommendations. One of them was that "serious consideration be given to the operational procedures for all aircraft with high angle of attack that emergency landings be made whenever possible in the wheels-down configuration to insure greater protection to the pilot."

Spinal Injuries

Vertebral compression fracture is the term used on the Form 14 to describe the spinal injury suffered by many pilots who have crash landed.

Even though the spinal column is an extremely flexible, anatomical engineering marvel, it has its weaknesses. When a "slap" load is placed upon it, the edges of each vertebra compress together and splinter or break. The little cushion disks between the vertebra also are mashed and the pilot often times suffers a severe, painful injury.

There are several significant rea-

Structural damage, top photo, resulted when F-86 hit fire plug. Aircraft came to rest at a 90-degree angle to runway direction.

In another F-86 accident the gear absorbed the landing shock. Top photo shows the second impact with the ground when pilot undershot. The F-86 bounced 300 feet from point of first impact, skidded approximately 400 feet then veered to right.

sons for a greater number of injuries during crash landings with gear retracted. When landing gear is up, impact forces are transmitted directly to the aircraft and crew. Also, landing in this configuration usually results in either an increased airspeed at touchdown or an increased nose-high attitude. A nose-high attitude causes the aircraft to literally "slap" the ground on impact, subjecting the crew to spinal injury.

During landing with gear extended there is a greater tendency to maintain appropriate landing speeds. Also, the increased drag created by the gear reduces the nose-high approach attitude and lessens the probability of nose "slap", following impact. Probably the most significant factor is that the extended landing gear absorbs initial impact, reducing forces imposed on the fuselage area and on crewmembers. Fracture the landing gear instead of your back.

Unprepared Surfaces

One of the first things I wanted to know as I went further into this subject was a definition of an unprepared surface and some examples of same.

Generally, an unprepared surface is any landing surface which is not a runway or a leveled and smooth overrun. (Overruns were considered only if there was construction, ditches or runway lips involved. This study did not consider forced landings on open water surfaces.)

Examples of some unprepared surfaces classified as rough, level terrain are ditches, ridges, rocks, sand dunes, plowed fields, swamps, desert, trees and tundra.

Rough, rolling terrain consists of trees, rocks, ridges, river beds, roads and hillsides. Smooth, rolling terrain includes hilly country, desert, roads and fields. And smooth, level terrain consists of lake beds, fields, roadways and beaches.

Next, I wanted to know about the comparison of damage done to an airplane with the gear up versus the gear down configuration.

Comparative Damage

Of 108 landings on unprepared surfaces, 70 per cent of the wheels-up landings resulted in destroyed aircraft. This compared to only 45 per cent that landed in a wheels-down configuration.

How about gear up versus gear down damage in undershoot and overshoot accidents? In 239 undershoot accidents, 75 per cent of the wheels-up landings resulted in destroyed aircraft, while only 21 per cent were destroyed that landed in the wheels-down configuration.

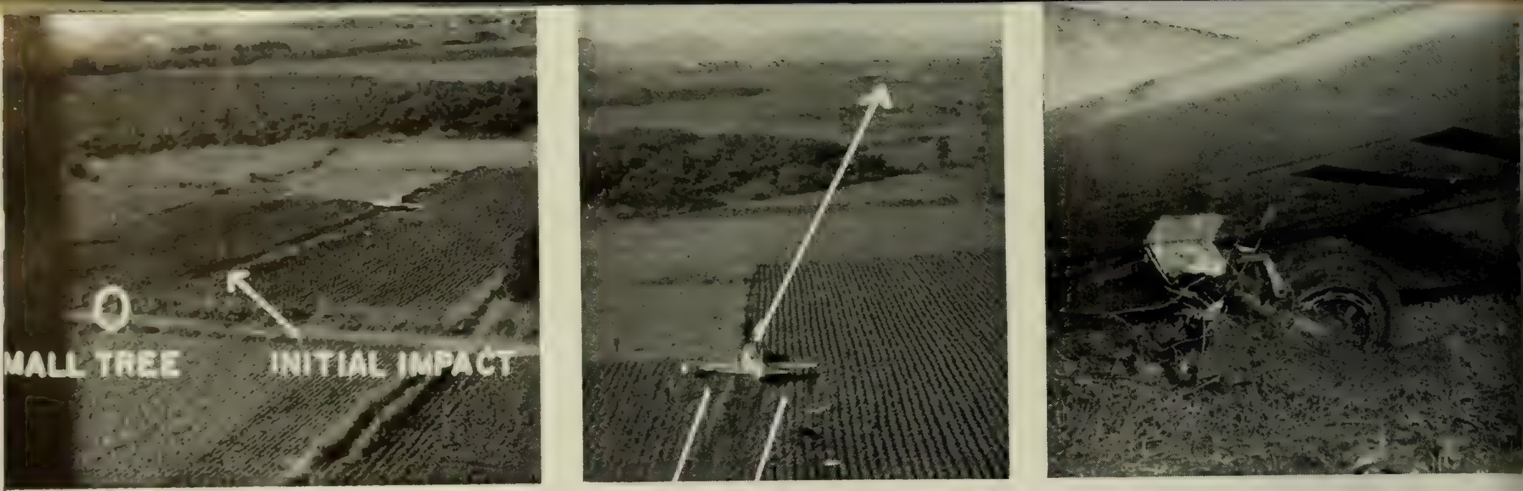
In the overshoot category, 45 per cent of the wheels-up landings resulted in destroyed aircraft in contrast to only 15 per cent with the wheels-down configuration.

I read these statistics. They looked good, but what actually happened on some of these crash landings? Let's look at a few.

- On a night flight, a pilot of a T-33 suffered hypoxia at altitude and regained consciousness at about 5000 feet. The pilot could hardly see the instruments and could not eject. During the landing attempt, the aircraft hit 1650 feet short of the runway in rough desert terrain consisting of soft sand dunes and mesquite brush.

The landing gear sheared, absorbing the initial impact forces and the aircraft slid 345 feet. The aircraft was destroyed and the pilot was injured. The item of importance in this serious accident, of course, is that the pilot survived.

This T-33 went through fence and drainage ditch. Entire nose section was torn free. Pilot was uninjured. Gear absorbed shock.

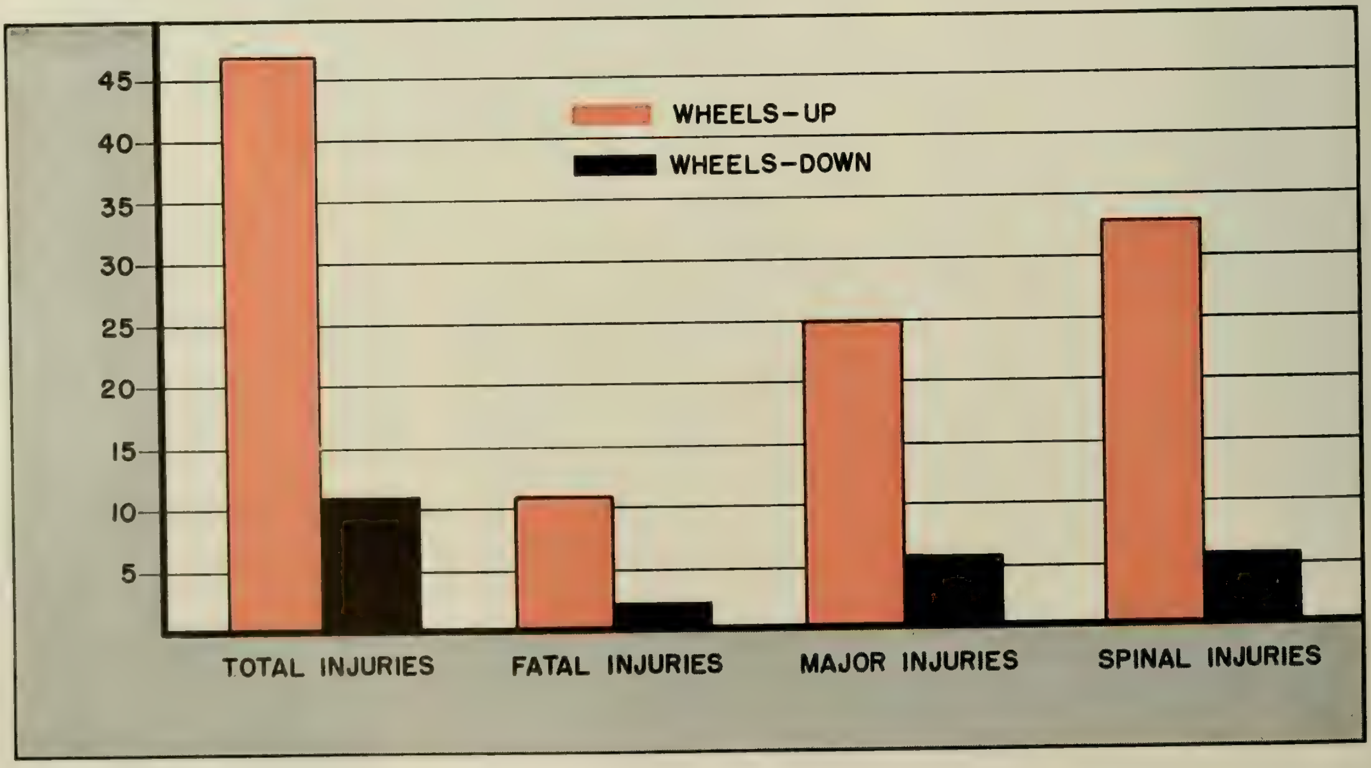


The aircraft contacted soft ground of a turnip patch at minimum flying speed, coming to a stop after skidding 216 feet. Leaving the gear down allowed the pilot to land in a normal attitude.

- An F-94C was landed in a nose-high attitude in a plowed field, wheels-down. The nose gear sheared upon striking an irrigation ditch. The aircraft continued, sliding on its nose section and main gear for 600 feet in the plowed field. The aircraft received substantial damage but the pilot was not injured.
- A pilot of an F-86F inadvertently left his gear down as he made a power-on approach for an emergency landing with minimum fuel. The landing area he had chosen was crisscrossed with seven ditches eight feet wide and five feet long. Weeds covered the ditches making the strip look smooth. Touchdown was normal and the aircraft slid 1800 feet over all seven ditches, shearing the landing gear and flaps. The aircraft was destroyed; however, the fuselage was intact. Although injured, the pilot got out of the aircraft and walked away.
- An F-84F made a wheels-down landing on a roadway. A normal approach was made to a 15-foot wide macadam road, which had shallow ditches on both sides. Culverts running underneath the road stuck out on both sides of the narrow road. After touchdown, the nose gear collapsed and the wing fuel tanks were torn off during the 3000-foot landing roll. Protruding ends of several of the culverts were struck during the ground roll, and the aircraft received substantial damage. The pilot, however, was not injured.

I continued to read down through the accident briefs in the study. I saw that they all pertained to landings on

Chart shows comparison of injuries when pilots have landed with wheels up and wheels down.



different types of unprepared surfaces. I think that the following report which I read summed up clearly what the entire study advocates.

- An F-86F went off the end of the runway and into a swamp containing tree stumps. The nose gear and wing tanks were torn off soon after entering the swamp and the aircraft slid through mud and tree stumps for 300 feet with the main gear intact. The aircraft was destroyed, but the pilot was not injured.

The pilot's comments concerning this accident are very significant. ". . . I might be criticized because I left everything down. But something seemed to occur to me. I have been thinking about our runway arresting barriers. It seemed to me that it might be better to leave my gear down and use the swamp just like a barrier. It worked. I just rolled off into the swamp and decelerated to a fast stop. I think the extended gear kept me from tumbling. . . ."

The term "tumbling" used by this pilot started me to thinking. To me, it had a psychological connotation. One of my first mental recollections of flying was of an airplane skidding on its nose and then tumbling over on its back.

This thought has stayed with me. I guess newspaper photos, eye witness accounts and other informational sources continually have influenced me. I had come to regard tumbling or flipping as a foregone conclusion if you crash landed gear-down or if the nose gear or main gear struck any sort of obstruction.

But listen to this. . . . There were no cases recorded where a jet fighter aircraft flipped or tumbled after landing gear-down. There were 86 accidents where, although the nose gear

The landing gear will withstand a terrific impact. This F-84 touched down short of the runway; the tire exploded and the aircraft slid on the wheel hub for 4500 feet.

The pilot undershot the runway and hit a rice field. The wing tiptank broke off as the plane struck several small dikes. There was no fire or explosion.

collapsed or sheared, the aircraft slid through various types of terrain without flipping over or tumbling.

What then is the explanation of these photos that show an airplane resting on its canopy or back with the gear pointing skyward?

Close investigation of these inverted type accidents disclose that the aircraft, in its ground travel, usually starts a side roll to the right or left. When this happens, any number of gyrations can result. Of 458 accidents there were eight wherein aircraft ended inverted after rolling over.

So the chances of flipping over or tumbling when accomplishing a forced landing with the gear down on an unprepared surface are comparatively nil.

Another thought came up. What do other fighter pilots think of this gear-down recommendation? I've talked with a lot of them, from all types of fighter outfits, too. They reacted to the topic like a cage full of tigers. They mauled it over, good. But the revealing thing about their conclusions was that once they saw how comprehensive the study was, how accident after accident report indicated that lives were saved, injuries lessened and damage to aircraft reduced, they were for it.

They were for it to this extent. If a guy had to make a choice of landing with the gear down or up, it would be with gear down. They emphasized and I'll reiterate, if sufficient altitude permits, your best bet is to use the nylon letdown.

If you are wondering about what to do with your external stores, do as the flight handbook says for the type of aircraft you are flying.

Further research projects have been initiated to see whether the same recommendation can be made for forced landings on bombers, transports and trainers. Also, a project is now under way to see what can be recommended when the gear is only partially extended. There will be more on this particular subject later.

Right now, however, there is one thing that you can count on. Your survival chances are better if you leave the gear down and locked to land on unprepared surfaces. ●

**At the present time, this gear-down recommendation does not apply to the F-89. A modification or redesign of the nose gear assembly will have to be made. When this is done, then this gear-down for crash landing recommendation will apply.*

Pilot aborted and a drainage ditch stopped this F-86. No injury to pilot. No fire.

WELL DONE

KNOWLEDGE . TRAINING

CAPTAIN ALBERT T. KEELER was on a cross-country flight out of Washington, D. C., when the left engine of his B-57 flamed out. He descended to 20,000 feet immediately, made a successful airstart and climbed back to 40,000. All engine instruments were indicating normal; however, he noticed that the fuel consumption was excessive. All fields in the area were below minimums, so he continued his flight and declared minimum fuel.

Over St. Louis radio, both engines flamed out, and during the descent, Captain Keeler turned off the inverters. The navigator handled all radio calls, leaving Captain Keeler free to attempt airstarts. At 15,000 feet the right engine was restarted but flamed out again. At 2500 feet the right engine was restarted once more and an emergency declared. At 1500 feet the left engine was restarted. Captain Keeler was below all clouds so he headed for the nearest Air Force base.

Setting up his landing pattern, he extended the gear but both engines flamed out. He turned immediately to the nearest runway which was 5000 feet long. The flaps would not operate and an overshoot seemed imminent. However, he spiked the B-57 on the runway as the first third point flashed by, and stopped with no damage to the plane.

A fuel check, after landing, revealed no usable fuel remaining. A defective "O" ring gasket had caused it to be pumped overboard. A total of nine airstarts had been made, four successful, five unsuccessful.

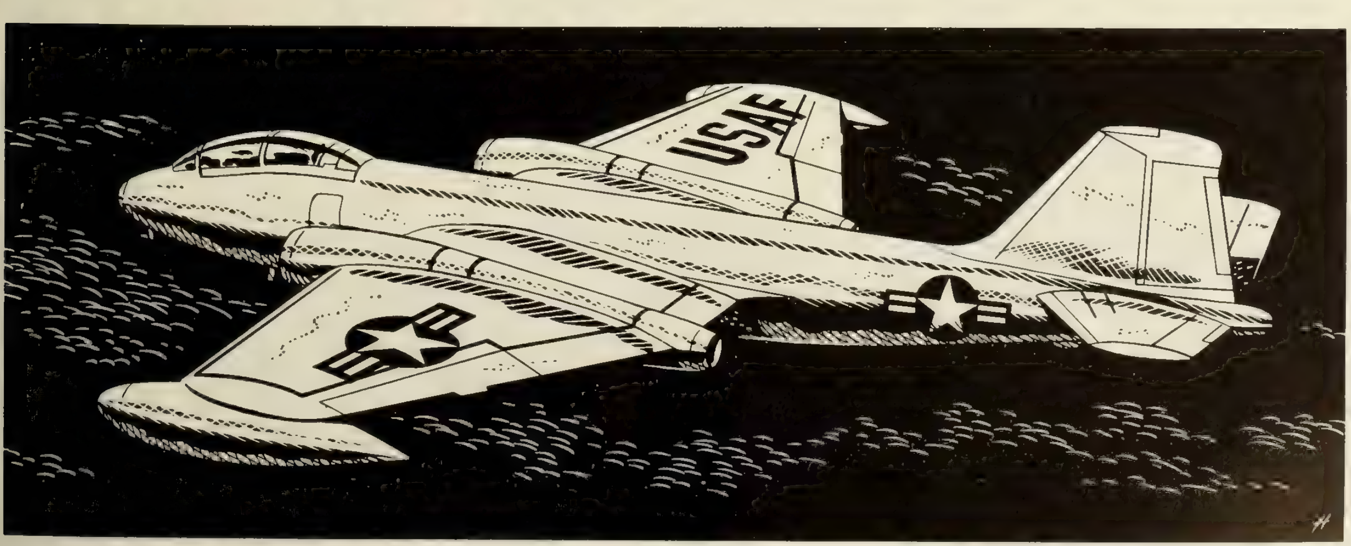
The cool judgment and excellent technique displayed by Captain Keeler is an outstanding example of professional airmanship. Well Done!

★ Captain ★

Albert T. Keeler

764th Bombardment Squadron, 461st Bombardment Wing (L), Hill Air Force Base, Utah

★



REX SAYS

I WAS BROWSING through our squadron flying safety reading file the other day when I came across as unusual and eerie a tale about flying as I ever expect to read. I thought old Rex would appreciate hearing about it.

The C-46 had been airborne about an hour, cruising over the dense Amazon jungle at 18,000 feet. Idly watching the thick, matted forest unfold was Ross Allen, the famous Floridian reptile expert, and a movie photographer, Dan Carley. Allen was worried about the cargo stowed aft.

He nudged the photographer, pointed over his shoulder and disappeared through the cabin door. A few seconds later, he came back.

"Hey," he whispered excitedly, "an anaconda's loose."

The photographer scrambled off the small jump seat. The two men bounded through the door and Allen paused long enough to snatch up a heavy burlap bag. They peered through the dimly lighted cargo section.

"There he is," Allen said tensely. He pointed toward the rear of the plane. They could barely make out the form of the 17-foot, 180-pound anaconda, which is capable of swallowing a pig or deer, as it slid over the blanket-covered cargo.

In the manner of a matador working a bull, Allen held the bag before him and cautiously approached the huge reptile's head.

"Get ready to grab his tail," Allen commanded. "And for heaven's sake, don't let him constrict. He'll kill both of us!"

The other man nodded and inched his way toward the rear of the cabin.

Now it was the anaconda's turn to sense danger. Its beady eyes watched Allen; its tongue flicked in and out, and its head wove back and forth. Suddenly, it struck.

Snake catching was old stuff to Allen. Deftly, he side-stepped. The ugly, tooth-laden mouth that was intended for Allen's arm clamped shut on the burlap bag instead. Allen seized the snake behind the head.

"Grab him!" Allen shouted. And both men hurled themselves on the thrashing reptile.

"Stretch him!" "Don't let him coil!" Allen yelled.

In the frantic moments that followed, they worked the reptile into the bag. Allen quickly bound and tied it with a stout cord. Stowing the sack away, they covered it with a blanket.

Both men were wet with perspiration. They knew the C-46's altitude had been on their side, for the cold temperature had slowed the anaconda's reactions. Quickly, they checked the rest of the cargo. Everything was in perfect order.

The rest of the cargo? A total of 3000 pounds of snakes—38 more anacondas, five powerful boa constrictors, two vicious spring tooth snakes, one deadly seven-foot bushmaster and a few ill-tempered, highly poisonous fer-de-lances.

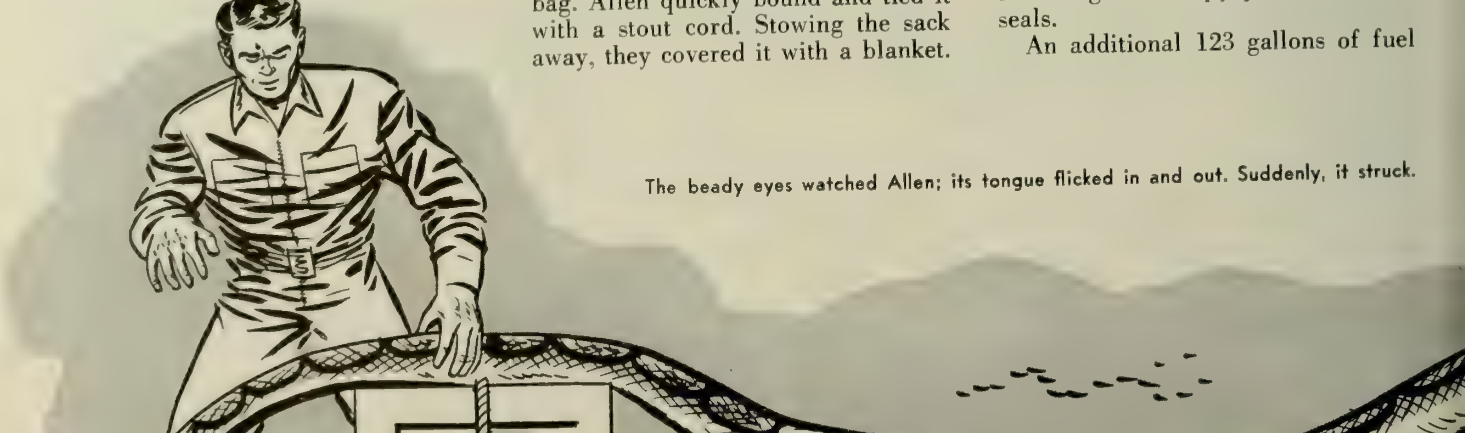
REX SAYS*—Credos to Mr. Allen. I have heard many a yarn about passenger trouble but this one wins the furlined pitot cover.*

★ ★ ★

I LANDED AT an Air Force base about 2030 hours and requested full service for departure the next morning. During my preflight check of the aircraft I found that the fuel in the tiptanks was about four inches below the filler neck in each tank. Further investigation revealed that this was noted in the Form 781.

The alert man went back to the alert shack to request more fuel and was advised that it was local standard procedure to leave T-33 tiptanks approximately four inches low upon servicing to prevent expansion and flooding of canopy pressurization seals.

An additional 123 gallons of fuel



The beady eyes watched Allen; its tongue flicked in and out. Suddenly, it struck.

were required to fill the tiptanks completely in this instance. The shortage of this much fuel in a T-33 aircraft could have placed me in a very serious situation had I not removed the caps and visually checked the tiptanks prior to takeoff.

This command prevents expansion and flooding by leaving tiptank caps loose and requiring pilots to tighten them prior to takeoff.

REX SAYS*—Just goes to show the trouble you can save yourself with a good preflight of your aircraft. When the difference is 123 gallons of go-juice, it could cause you some exciting moments about the time you get close to your destination.*

★ ★ ★

I WAS PULLING AO duty. I glanced at the clock and it said 2145 hours. I asked the weather man what he was reporting and he told me, "Eighteen hundred broken, 10 miles."

The squawk box blared, "Ops, this is the tower. There's a T-33 on the runway. He just up and landed without making a call at all. You got anything on him?"

Well, I took my feet off the desk and hustled out to the ramp. And believe you me, what had transpired to get this T-Bird on the runway at my base when he should have landed at a field some 20 miles away, is something hard to believe.

This bewildered lad first filed an IFR flight plan to my base which does not have a published jet letdown procedure. En route he was advised of this and changed his flight plan for the other base which was approximately 20 miles away.

So he tooled merrily on his way until he was over what he thought was the proper range station to start a penetration. Only this dude forgot the cardinal rule about tuning in a radio compass. What? Why, that properly identifying the range station is a must.

RAPCON enters the episode now. They located a target making knots toward some clouds that happened to have a lot of hard centers in them, like, maybe, mountains.

They contacted this aircraft and advised the pilot to turn to a heading which took him away from the mountain range. Shortly thereafter, the RAPCON boys sighed with relief when the blip scooted out of danger.

Next, they advised him of his present position. He replied they were wrong as he had the field in sight. RAPCON then requested the pilot to ask for a DF steer. But, by this time, the pilot had startled the wits out of our tower operators by landing here, at my base.

After looking at his Form 175 and getting RAPCON on the horn, he was more than slightly convinced that he had made a boo-boo.

REX SAYS*—Yes, sir, and friend, this type of operation can make a guy a long time dead.*

★ ★ ★

IF YOU HAVE some extra space in the Rex Says column, I'd like to spell out for the troops a little episode that I witnessed in a Danger Area recently.

The missiles that I carry underneath my airplane are unerring in their trajectory to a target. There's a swoosh, some smoke and blooey!

This one day, I "locked on" a target and was counting off the seconds to missile release time. Sixty, fifty nine, fifty eight and so on. This target didn't have a ghost of a chance of escaping destruction.

Then it came. Within 40 seconds of missile release time, it was determined that this was the wrong target. What had happened?

Some numbskull, who evidently had gotten away with violating restricted areas before, had crossed over into our airspace where we were doing some serious business.

I imagine by now he's heard about this violation. However, I thought that all fly types ought to take a second gander at the location of these restricted areas on navigational charts and the Fac Charts. You're liable to be "locked on" if you're not careful.

REX SAYS *— Another instance of some joker who doesn't believe in planning a flight carefully. The information is available, so use it. This cat was using up his nine lives at a rapid rate, believe me.*

★ ★ ★

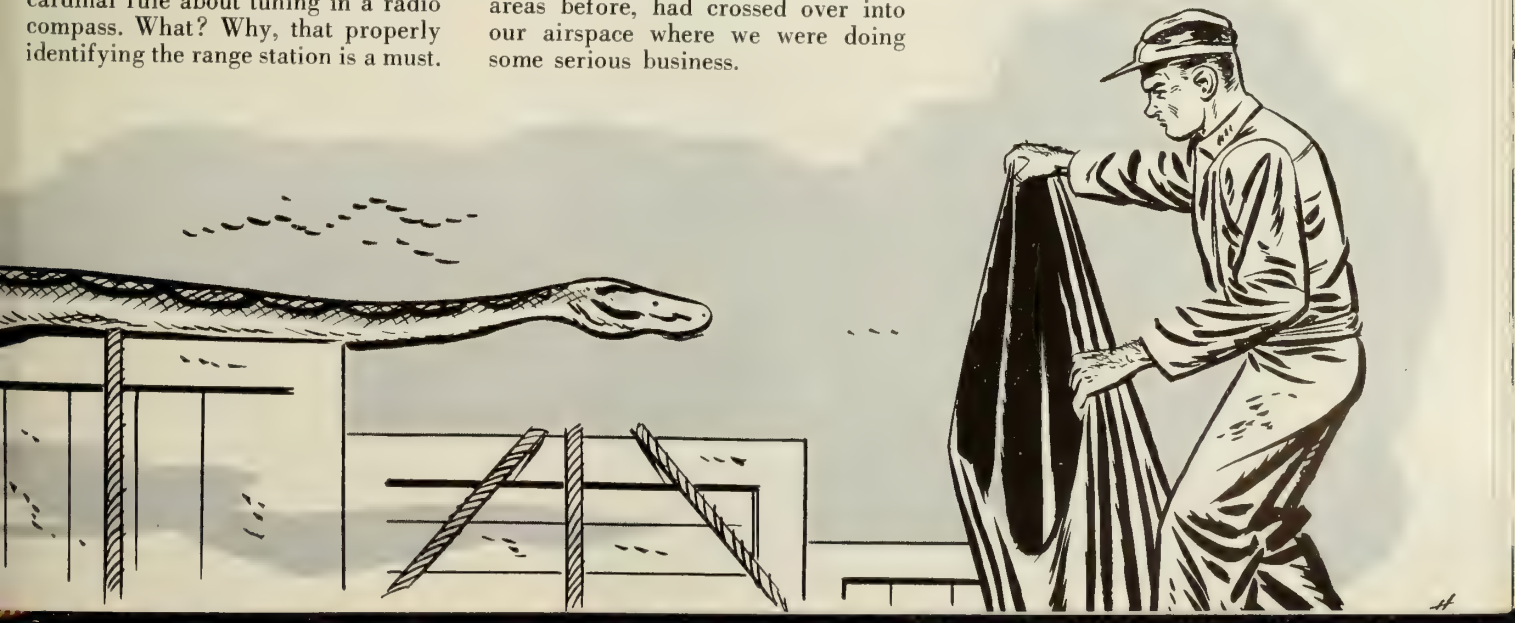
WHILE ON a routine flight last summer, an Air Force C-47 landed at an overseas, foreign, commercial airport and refueled.

Shortly after the aircraft had been refueled, the plane was struck by lightning. The bolt passed through the aircraft and grounded through an airman standing under the wing. The pilot took immediate resuscitating action and saved the airman's life.

The moral of the story is that commercial airports might not always ground aircraft adequately, when servicing. The probable cause of lightning striking in this case was a high concentration of static electricity in the aircraft as a result of improper grounding. Also, crewmembers and other personnel should never stand under the wing of an aircraft during a thunderstorm.

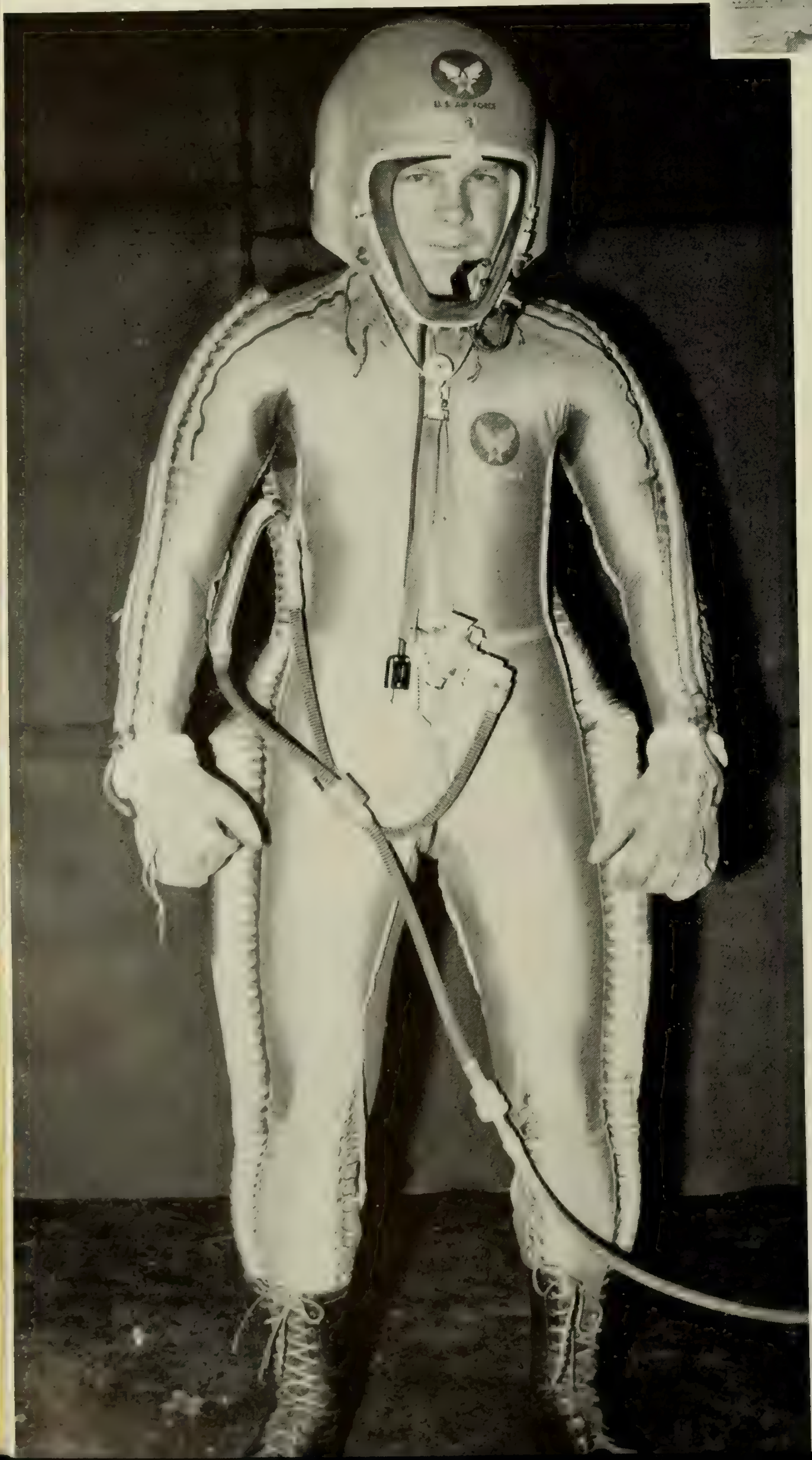
Crew chiefs and pilots should make sure that the aircraft is grounded properly during servicing.

REX SAYS*—Sound advice. It would be interesting to know if the grounding wire at the tailwheel was touching the ramp. That should be a part of the preflight inspection just for this very same reason.*



You've got to dress for the occasion when you fly at extreme altitudes. Check these styles.

Fashioned for HIGH



High flying requires adequate protection. The inflated partial pressure suit is a must.

THE JET CAME charging down the runway. As it neared two men standing nearby, its great speed became more and more evident.

Suddenly, it was overhead, still silent and still traveling fast. An instant later, a whooshing roar beat down, hammering at the two men and revealing at last the terrible power of its jet engine. As fast as it came, just so fast it left; its tailpipe roaring out a whine that grew fainter and fainter as it fought for altitude.

"Man! That's too fast for me," one exclaimed in awe. "An airplane that can go like that just isn't safe. Give me the good old prop jobs of the big war. Now, there were safe planes."

The colonel, who was his companion, chuckled quietly. "Yes, that's a pretty fast airplane, but you haven't seen anything yet! Most of our jets have to dive to break the sound barrier, but coming off the assembly lines are several airplanes that cross the sonic barrier in level flight. They're really fast."

"That's just what I mean," exclaimed the other officer. "They're just too danged fast to be safe. It's taken the romance out of flying."

Advance in Speed

"If by 'taking the romance out of flying' you mean fear and danger have been injected, you are probably half right," the colonel answered. "It's true that higher speeds and higher altitudes are more dangerous than the 100 and 200 mile-an-hour clip of old planes. It's also true that pilots today are busier and have to be more alert than in the old days.

"But is that any different than

Living . . . . .

. . .

C. Carroll High, Jr.
Hqs ARDC

ground transportation? Don't our automobiles move faster today than they did a couple of decades ago? Yet, we think nothing about it.

"As you know, aviation medicine is my field and I would not presume to speak for the aircraft designers or the engineers and scientists who design and develop the equipment that goes in an airplane. But I can tell you of some of the advances made in the way of personal equipment to protect our high-flying pilots in this day of faster-than-sound travel.

G Force

"For instance, one hazard introduced by speed is G force. In a jet airplane these forces can get pretty terrific. Under positive G force, your blood tends to pool in your legs and abdomen and with loss of blood in your brain, you will black out.

"Aero medical research has developed an answer to this problem. A suit, designated the MB-2 anti-G coverall, was devised at the Air Research and Development Command's Wright Air Development Center. It operates on a bladder system so that pressure is applied to the flier's legs and abdomen when needed.

"Whenever the plane makes a turn that sets up a G force on the pilot, a valve opens, letting in air supplied by the aircraft's compressor. The higher the G force the more the valve opens. The bladders tighten and prevent the blood from pooling. This suit, made of 50 per cent nylon and 50 per cent cotton, is now standard throughout the Air Force."

"It sounds pretty uncomfortable," his companion broke in.

"Not at all," the colonel answered. It is no more confining than an ordinary pair of flight coveralls, and it is reassuring to know that any maneuver you could make would break up the airplane sooner than it would black you out."

Pressure Suit

"Now take this altitude thing," the colonel continued. "You have been around airplanes enough to know that the higher you go, the thinner the air. Designers have pressurized cockpits so that a pilot traveling at 40,000 feet, for instance, can enjoy the equivalent of the relatively safe altitude of 15,000 to 20,000 feet.

"But the Air Force is flying combat planes and anything can happen—in combat or out. A canopy cracked or smashed by gunfire at 50,000 feet could result in the death of the pilot from lack of oxygen. An oxygen mask would help at this altitude, if he descends immediately, but suppose the plane was higher—say, 63,000 feet.

"An unprotected man at that altitude would be subjected to a number of stresses, any one of which could cause his death. Besides the lack of life-sustaining oxygen, his body tissues and gases would expand, endangering his internal organs.

"A great deal of research into this problem has been carried on by scientists in WADC's Aero Medical Laboratory. They have developed a workable emergency suit, but the goal is a suit to give protection over a much longer period of time.

"In use now is the T-1 partial pressure suit. This garment encases a pilot snugly from neck to ankles. Along the arms, sides and legs are capstans, which are hollow tubes. When inflated, they tighten laces, which in turn tighten the cloth around the arms, legs and body.

"Normally this suit is worn inflated along with a pressure helmet, either the MB-5 or the K-1, into which oxygen is introduced. If the cockpit should suddenly lose pressure, oxygen is forced into the helmet under pressure and also into the capstans on his suit. The oxygen thus forced into his blood during breathing permits him to retain consciousness, and counterpressure from the suit tends to keep his blood flowing in a normal fashion.

"Since this is only an emergency suit, a pilot is expected to bring his airplane down to a safe altitude as quickly as he can. Tentatively standardized is an advanced version of the T-1 suit, designated the MC-1. This is the suit that undoubtedly will be a standard item of clothing for the high-flying pilot of the future."

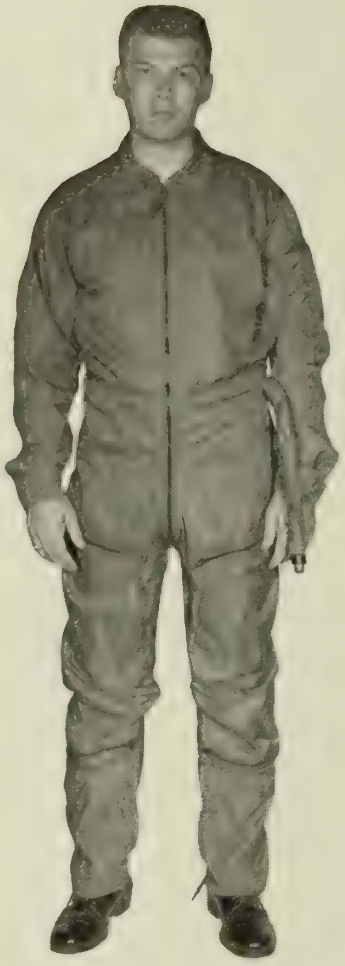
"That sounds awfully warm to me," the old veteran ventured. "First an anti-G suit and now a T-1 suit."

"You are so right. It is warm, but you haven't heard anything yet.

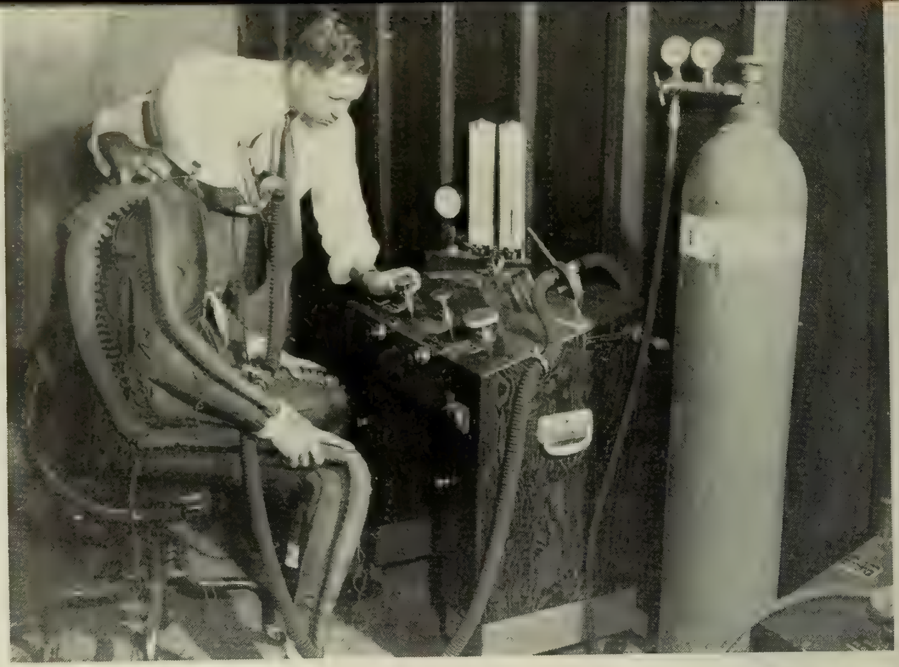
Anti-Exposure Suit

"When it comes to a hot suit, you should see the MD-1 anti-exposure suit. This rubberized nylon garment is designed particularly for drops into water or cold areas and furnishes an air-tight, water-tight covering from the neck to the soles of the feet.

"Attached to this suit are overshoes large enough to be worn over the combat boots normally worn by aircrew members. At present, airmen wear the Mark IV rubber boot, developed jointly by the Air Force and the Navy, but with this type of footgear, it is



This is the coverall type of anti-G suit.



Before wearing the partial pressure suit operationally, a pilot learns pressure breathing.

impossible for the downed airman to shed his anti-exposure suit unless he doesn't mind going barefoot.

"The new anti-exposure suit has a V-closure to keep out water or air and is worn over the XMD-3 liner. In reality the liner is a pair of coveralls, greatly resembling the ordinary flying suit, and can be worn as an outer garment. Both these suits should be standardized within six months. All these layers of cloth would make the pilot really uncomfortable if it weren't for one other piece of clothing.

"This is the MA-1 ventilation garment, which should be standardized about the same time. Realizing that the problem of cooling would come up, the Aero-Med Lab developed this suit which is often called an air-conditioned garment.

"By means of hundreds of tiny holes, air pumped by the aircraft's compressor is forced around the pilot's torso. Larger holes allow the air to escape to the liner and anti-exposure suit. In the latter garment are dump valves at the wrists and ankles where the air must travel to escape. This air evaporates a man's perspiration, thus cooling him. Its principle is the same as the water bags that travelers carry on the front of their cars while crossing a desert."

Ejection Seat

"All of this is very well," the old veteran said, "but if something should go wrong up there, it still looks mighty dangerous to bail out of a high-flying, high-speed jet."

"Yes, there's a certain amount of danger," the colonel admitted, thoughtfully. "But the Aircraft and Equipment Laboratories at WADC are doing all they can to minimize it.

"The Aircraft Lab, for instance, has developed ejection seats that shoot a man out of an airplane either upward or downward. Automatic devices disconnect the lap belt and deploy the parachute some time after the seat falls clear. But more about this later.

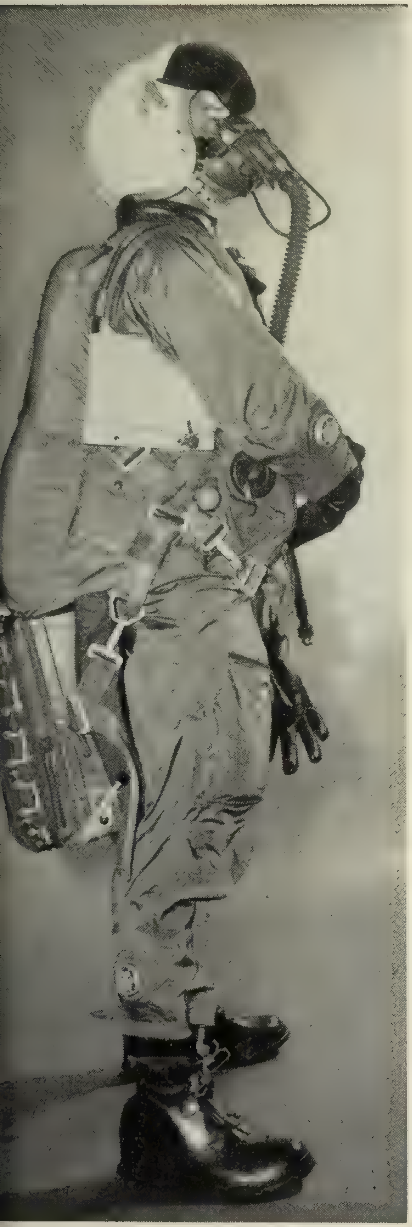
"The Equipment Lab, concentrating on parachutes in this case, has developed a guide surface chute that has a lower opening shock and is much more stable than the present one. To illustrate how safe this new equipment is, two of our test jumpers at the Aero-Med Lab ejected successfully from a B-47 at 45,200 feet. There is little likelihood that it will be necessary for pilots to bail out at that altitude for some time to come (they should be able to get lower before leaving the plane), but it's nice to know that they can bail out from that altitude and live.

"At another time, one of these same jumpers ejected from a B-47 traveling at 570 miles an hour (423 knots IAS at 10,000 feet). He suffered no ill effects from the ejection.

"I guess you've convinced me," the old veteran said, "but how does all of this bailout equipment work?"

Automatic Release

"I'm glad you asked that. When a pilot is strapped into his ejection seat —either the upward or downward type—he will wear one of two para-



Left, pilot is wearing anti-exposure suit. Above shows underarm life preservers, back type parachute and the A-1 survival kit.

chutes, the standardized seat-type chute with Class III harness or a back-type chute, also with Class III harness. Although a new back-type chute, utilizing a low-shock canopy, has been standardized, only a few are presently available for testing.

During ejection a lap belt cartridge containing a two-second delay element is triggered. At the end of the two seconds, the main powder charge supplies gas pressure to force open the lap belt latch mechanism, allowing the crewman to separate and fall free of the seat.

"As he falls from the seat, a lanyard with key connecting the lap belt and his parachute's automatic opening timer, pulls the arming handle free, setting the parachute timer into operation. At the end of a two-second interval, the timer then opens the parachute.

"The timer also is pre-set prior to flight to open at 5000 feet above the highest terrain over which the airplane will fly, but in the mill is a plan to have the timer pre-set at the factory to open at 15,000 feet. In high-altitude ejections, the crewman will free-fall until he reaches the preset altitude. This altitude setting should be low enough to keep the parachute-opening shock at a minimum. But both the lap belt and parachute can be operated manually at any time by the descending airman if he so desires.

"The new parachute was specially designed by the Equipment Lab. It has small pockets around its edge, called guide surfaces, which permit a more stable descent. The harness is designed with interlacing straps so that it can be easily adjusted with one motion. Designed to hug the pilot's back, the new parachute can be donned like a vest and is 16 per cent lighter than earlier models. Already standardized, this parachute is being purchased now.

"The crewman's job isn't finished when his parachute deploys, however. If his drop is into water, he must inflate his life raft. The modified A-1 global survival kit normally is stowed in a compact package to fit into the ejection seat. When he leaves the seat, the survival kit remains right with him.

"After ejection, the crewman pulls a release, which forces carbon dioxide into the life raft. As the raft expands, it forces open a zipper, running around three sides of the container. When the zipper is fully opened, the container's contents then fall out.

"The raft continues to inflate and hangs suspended from the pilot at the end of a 10-foot line. Attached to the raft is a 15-foot line, at the end of which hangs the accessory kit."

"It seems to me I've seen pictures of that," the old veteran broke in. "But wasn't the raft on the bottom and the accessory kit in the middle?"

"You probably saw a picture like that," the colonel replied. "We have tried it both ways and find little difference in effectiveness. The kits on order now, however, have the raft in the middle. Some of us feel that the accessory kit, by its heavier bulk, gives greater stability during the descent by being on the bottom.

"He also is equipped with the MA-2 underarm life preservers. This preserver consists of two compact units, one fitting beneath each armpit.

"He opens a valve to inflate the two units with carbon dioxide, or, if his drop is over land, he can discard the units. Superior to the Mae West type, this preserver provides better flotation and keeps the wearer more upright in the water. Also standardized, it is being readied for immediate production.

"You can see the set-up now. When the pilot reaches the water, he has his raft and accessory kit attached to him. By drawing the raft to him, he can be out of the water in a matter of seconds. This could mean the difference between life and death under certain circumstances.

"The new gear also provides for disposal of the parachute, which could drag a man to a watery grave. After the pilot inflates his life preservers and his raft, he can release the canopy quick releases on his harness. As soon as his feet hit the water, he can complete the action by flipping the catches and disposing of the parachute canopy completely. Or, he can release one side and retain the other. This will deflate the canopy and still leave it attached to him for possible later use."

"What do you mean 'later use'?" The colonel's companion asked.

"The canopy parachute is one of the most valuable pieces of survival equipment a pilot has. While on the water, he can use it to protect him from the cold or the sun, and he has a ready-made sail. After reaching land, he can use it for a tent, sleeping bag or hammock and with its red and white panels, is serves as an excellent signaling material.

A-1 Survival Kit

"But to get back to the A-1 survival kit. At present, we are using the C2-A kit with PK-2 raft, which must be inflated after striking the water. With the A-1, a pilot can be in the raft in 10 seconds, while it will take

Life raft and accessory kit stay right with pilot. He can be in the inflated raft within 10 seconds.

at least 60 seconds with the PK-2 raft. But the A-1 isn't the last word. Soon to be standardized is the MB-1 container, an improvement on the A-1. It will have a pin and cone closure, ejector snaps for attaching the kit to the harness, and the depth of the seat will be fixed. Otherwise, it is the same as the A-1.

"The A-1 also is known as our global survival kit. The accessory kit contains items that make survival possible in any part of the world—in the Tropics, the Arctic, on land or water. I have a paper here with a list of items in the kit. Listen to this—it sounds a little like a mail order house catalog.

"The bag contains two pairs of socks, a fish net, spoon, compass, ski goggles, a 22-calibre (Hornet) bolt action rifle, sea water de-salter kit and water container, signal flares, candle, salt tablets, razor, matches, pocket knife, sharpening stone, first aid kit, signaling mirror, small stove and heat tablets, emergency rations, sending and receiving radio set, fishing kit and a survival manual.

"Even a man unfamiliar with the kit need only take time to read the manual to learn how to use all of the equipment it contains and to get some helpful survival tips. The Air Force leaves nothing to chance."

"But," interjected the old veteran, "not every pilot flies a global mission. Most flights are made in certain areas—entirely over land, for instance—and a downed pilot might wind up with fish hooks and nets when he could use more emergency rations than the kit calls for. What about this situation?"

The colonel was ready with an answer. "We have just initiated what we call base packaging. Authority has been given to base commanders to vary the contents of the kit to conform to the missions his pilots normally make. For instance, where flights are predominantly over desert country, additional water and emergency rations might be added at the expense of the de-salting kit. The kit as now constituted with base packaging is extremely flexible.

"As you can see," the colonel summed up, "while our planes are flying faster and higher and encountering conditions never dreamed of only a few years ago, the Aero-Med Lab has been fighting to keep man abreast of, or ahead of, his machine.

"Our first consideration is man's safety. It costs a lot of money to make a good jet jockey and it would be poor business to toss man and machine away indiscriminately — aside from the humanitarian standpoint.

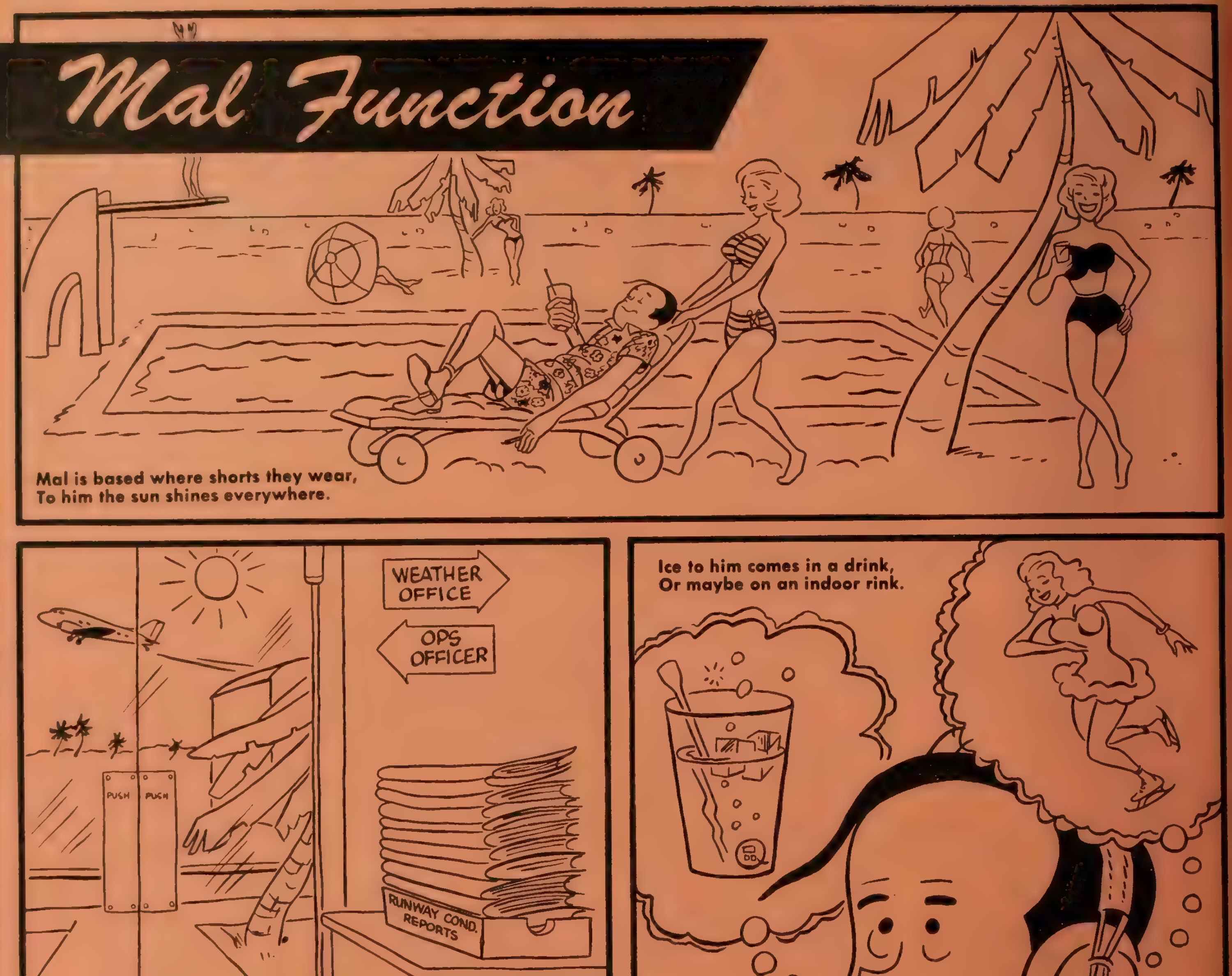
"Our second consideration is a man's comfort. Yes, I said comfort. An uncomfortable pilot or crewman is an inefficient crewman and the speeds and altitudes of present-day military aircraft demand the highest efficiency a man can give. ●

Into raft is first step. Note underarm life preservers. Below, man on right shows close-up.

When You Hit the Dirt!

Besides being nice to look at, this little gal is illustrating the latest technique for landing on unprepared surfaces. The whole story is on page 16, "Down, Boy, Down!" Like the lady is demonstrating, there are some mighty interesting angles in the article.

Mal Function



Mal is based where shorts they wear,
To him the sun shines everywhere.

When he takes off for ole St. Joe,
Ignores reports on ice and snow.

Ice to him comes in a drink,
Or maybe on an indoor rink.

Up here the runway's really slick,
To keep plane straight is quite a trick.

Mal ends up in big snow hill,
And FSO starts paper mill.

°U. S. GOVERNMENT PRINTING OFFICE . . . 362331

629.1305
FLYS

FLYING SAFETY

UNITED STATES AIR FORCE

MARCH 1956

THE LIBRARY OF THE
MAR 27 1956
UNIVERSITY OF ILLINOIS

BOUNCING THRU the BOONDOCKS

Page Four

FLYING SAFETY

VOL. TWELVE NO. THREE

- The finer points in taking off in an F-86 are covered by one who should know, on page 22.

- Page 14 relates an experience that possibly could happen to any of us. The pilot involved is with us today only because he was thoroughly familiar with his equipment and procedures.

- Besides being beautiful to see, contrails are an aid to defense. The story is on page 26.

Beware—Twister at work. See page 10.

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

STAFF

Editor
Major Perry J. Dahl

Managing Editor
Major Jesse F. Townshend, Jr.

Art Editor
M/Sgt. Steven A. Hotch

Production

Major Ben H. Newby
T/Sgt. Chester D. K. McCubbin
T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune
T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

Page
Safety—A Product of Proficiency 2
Bouncing Thru the Boondocks 4
Well Done 9
Tale of the Twister 10
Keep Current 13
One-Two-Three-Bloop! 14
"Nothing" Can Be Dangerous 16
Rex Says 20
Off and Running 22
High Signs 26
Lucky Thirteen 28

★ ★ ★

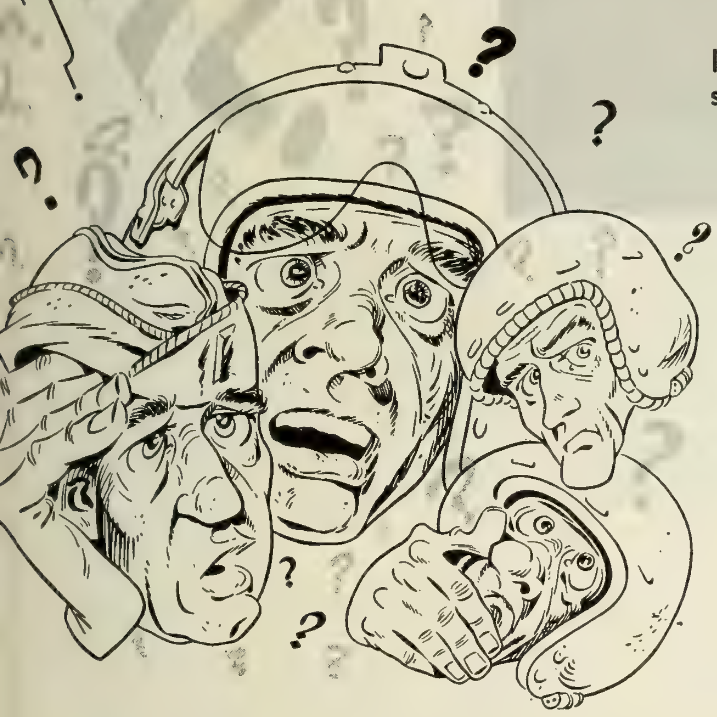
SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

How Well Can You Remember ?

If you miss more than four, better thumb through some back issues. And don't peek at the answers.



JANUARY

1. The ice on most arctic lakes is thicker and stronger than salt water ice.
   - *a. True*
   - *b. False*
2. How many aircraft can RAPCON handle safely in their landing pattern at one time?
   - *a. 9*
   - *b. 3*
   - *c. 5*
3. The maximum angle of bank attainable with the turn knob of the F-86D autopilot is:
   - *a. 45-50 degrees*
   - *b. 80-90 degrees*
   - *c. 25-35 degrees*
4. The odds are 21 out of 100 that if you have an accident in a T-33, it will be of what type?
   - *a. Undershoot or hard landing*
   - *b. Fuel starvation*
   - *c. Overshoot*
5. How many feet above normal unloaded position is the B-52 wing capable of flexing?
   - *a. 10 feet*
   - *b. 17 feet*
   - *c. 22 feet*

FEBRUARY

6. In flying the F-100C with external stores, lighting the afterburner, will cause the nose to pitch:
   - *a. Up*
   - *b. Down*
   - *c. Stay neutral*
7. What is the maximum design speed for the drag chute in the F-100C?
   - *a. 180 knots*
   - *b. 220 knots*
   - *c. 150 knots*
8. Before reaching final approach, what is the best IAS for the F-100 emergency landing pattern?
   - *a. 220 knots*
   - *b. 180 knots*
9. Your chances are better if you have to land a jet fighter on unprepared ground surfaces with the gear. . . .
   - *a. Down*
   - *b. Up*
10. Prior to flight, the timer on the automatic type parachute is pre-set to open at. . . .
   - *a. 3000 feet above highest terrain*
   - *b. 1000 feet above highest terrain*
   - *c. 5000 feet above highest terrain*

MARCH

11. Where and when does the zone of tornadic activity start?
   - *a. In October in the northeast states*
   - *b. In February in the southeast states*
   - *c. In May in the central states*
12. Which type of contrail remains visible for the longest period of time?
   - *a. Aerodynamic*
   - *b. Engine exhaust*
13. You can get tired from doing nothing. This type of fatigue is called?
   - *a. Dynamic*
   - *b. Static*
14. What UHF channel is used for direct pilot-to-forecaster weather information?
   - *a. Channel 1*
   - *b. Channel 9*
   - *c. Channel 13*
15. At what position would placement of tailpipe segments on F-86s increase nosewheel lift-off speed?
   - *a. 6 o'clock*
   - *b. 12 o'clock*
   - *c. 3 o'clock*

ANSWERS

1.	a	4.	a	7.	a	10.	c	13.	b
2.	b	5.	c	8.	a	11.	b	14.	c
3.	a	6.	b	9.	a	12.	b	15.	b

SAFETY a Product of Proficiency

Colonel Willis E. Beightol
Chief, Flying Safety, Hqs MATS

ANYONE WHO TRIES to define flying safety in terms of its essential elements soon becomes aware that it is divided into many facets. It is very difficult to place them in any order of importance. However, the matter of proficiency and its safety implications should rate high on any pilot's flying list.

An accurate observation, although slightly mixed up in expression, seems to define this subject. "Proficiency is what, if you have enough of, you won't get into trouble as quick as when you think you have plenty until an accident shows you didn't."

Everyone has at least a general concept of the practical meaning of proficiency, so let us turn our attention to the answers of some questions which are intended to provoke some serious thinking about your own individual state of proficiency.

How do we normally rate ourselves as to our skill level of proficiency? First of all, we have an annual proficiency check. Often we get this check at the same time as our annual flight check although the two tests should be at different times. What does this proficiency check tell us? Simply this: At that particular time, under almost ideal conditions and with an IP who will keep us out of trouble, we are capable of operating that particular airplane within acceptable limits. We can get the machine into the air, perform certain basic maneuvers and demonstrate, in

To fly safely and complete your mission in an efficient manner, proficiency in the type aircraft should be rated high on the list.

Practice steps up proficiency. Each phase of flying must be covered. Notice feathered props.

a rather loose manner, some familiarity with the emergency procedures. The final blessing is then given by means of a signature on a certificate. You have it made for another year. But, have you, really?

Are you honestly confident that you can cope with combinations of adverse and unforeseen factors your experience tells you exist? It is of little consequence to rationalize that you used to be able to hack anything, nor does it follow that once you have been through some rough encounters you can get through them again.

Why is this so? Because your proficiency is not the same, particularly if you are occupying a position that limits you solely to readiness-type flying training.

That annual proficiency check should be more than just an inconvenience to get out of the way. Consider the check instead as a way of determining where your flying is weak and needs strengthening.

The word practice may be trite but no one can deny that proficiency comes from practice.

A person in an aircraft who knows the pilot has flown the route often in the recent past and under harsher conditions rightfully feels secure. The pilot is proficient; he is practiced. Practice then provides a second clue to our skill level.

When was the last time you practiced a particular phase of flight? How much time did you spend doing it, and were you really certain that you could accomplish it safely under the stress of critical conditions?

Practice steps up proficiency. A baseball player who has a low batting average probably practices more intently than does his team-mate who leads the league in batting. The ball player's proficiency is tested every time he comes to bat and if he strikes out, he gets another chance. No one but you can know your batting average precisely and, if you strike out, there is seldom another chance.

Here are some ways in which we can enhance our proficiency. First of all we can make each hour that we fly count for some type of practice even if it is simply making a position report in a concise professional manner or re-acquainting ourselves with the contents of the Radio Facility Charts and other flying manuals.

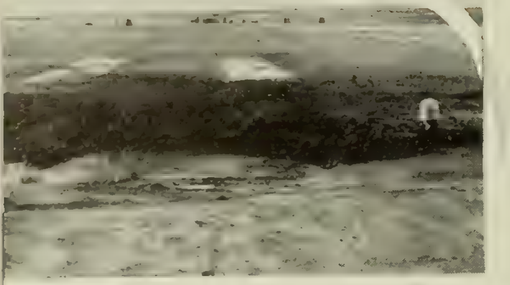
Next, as we practice each phase of flying, we can be critical of our own abilities, and if we are having difficulty or if we are not completely confident that the particular item is mastered, let's ask for assistance. It's a wise man who knows his limitations.

Proficiency then is that which you know you have and not what you think you have. ●

Colonel Beightol graduated from flying school in 1939 and served in World War II on both sides of the globe. He received the DFC for his part in the first low-level raid of the Ploesti oil fields. In the Pacific he was assigned to the 33d Bomb Wing.

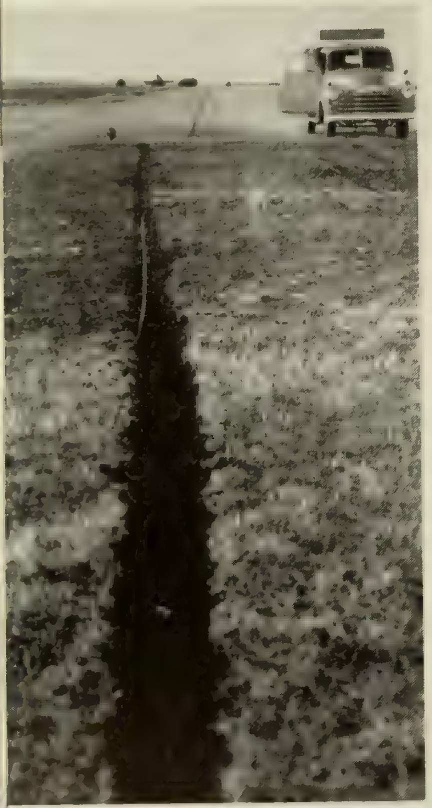
In February 1954, as a Task Force Commander of the 5th Strategic Reconnaissance Wing, Colonel Beightol participated in the first and only non-stop flight from Japan to the U. S. East Coast.

Colonel Beightol is a graduate of Michigan State College and attended the Air War College prior to his present assignment with MATS.



Bouncing Thru the

Here is a story on undershoots. This category of accidents has reached number one on the "hit" parade. Don't you join the throng.



To land one in the toolies
is no fun indeed.

I undershot the runway
and clobbered up my steed.

I quit flying on the final
when I thought I had it made.

So now I'm a statistic
thank the Lord that I'm not daid.

YOU MAY NOT THINK much of our poem but at least it might make you conscious of the fact that this problem of plowing up the daffodils at the approach end of the runways is getting to be contagious.

It's happening in the Far East, the Near East, the North, South and West; yes, it's happening all over. Seemingly, it makes no difference whether the runway is bordered with snow or rimmed with clover. It's still happening almost daily.

Before this discussion gets down to some concrete facts (pun intended), scrounge around your ready room or base operations and take a quick glance at the article entitled "That Magic Area," published in the July 1955 issue of FLYING SAFETY. There is a veritable gold mine of information in there on how to set up a safe landing. The author points out that you should fly your machine right down to the threshold of the runway. Control your descent, enter the magic area at the proper airspeed and you will never land short.

Now for some facts.

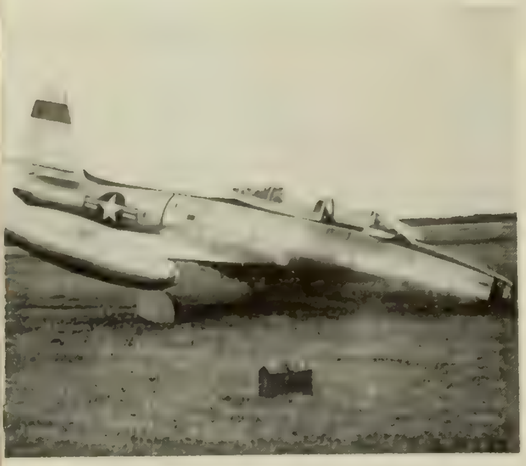
Do you know who is tiptoeing through the tulips the mostest? None other than pilots with 500 hours of total time or less. But don't think that the old hands aren't contributing to this particular statistical column, too.

Does the length of runway have anything to do with undershooting? No. Statistics show that with jet aircraft, almost 75 per cent of the undershoot accidents occur on runways of 7000 feet or longer.

Non-emergency Undershoots

The landing phase of flying claims the highest number of all accidents.

Pilot misjudged distance. Landed 100 feet short. Nose gear plowed up sod, then folded.



Throttle applied too late. Landed 50 feet short in construction area. Left, note impact marks. Plane rolled to edge of runway and both main gears sheared. Right, see lip.

Boondocks

The bouncing ball, opposite page and above shows how this T-33 finally settled down.

And in this category the dubious honor of claiming first priority goes to non-emergency undershoots.

So what can be done about it? Like a competent physician who endeavors to halt the outbreak of an epidemic (and brother, undershoot accidents are approaching that stage), let's list the causes and sift out some possible solutions or remedies.

To get at this undershoot problem, you lovers of flying will recall the wildlife movies of the migrant duck who is returning to his nest in the north after a sunny winter down south. He enters the initial penetration, pitches out, lowers his webbed landing gear and is all set up to sit down nice and soft.

Then, the next frames of this movie show him skimming along the icy surface of the pond on his derriére, frantically clawing to regain his balance. He usually winds up by hitting a crash barrier composed of four or five of his fine feathered friends who shake themselves disgustedly and look down their long bills at him.

As you recollect this humorous action, let's carry on a bit further. As

Pilot failed to maintain sufficient altitude and airspeed to compensate for gusty wind conditions. T-33 struck wooden warning fence, above, bounced and slid to stop.

The F-86D slid on its external fuel tanks and nose gear for approximately 1500 feet.

far as is known, there are no statistics on the landing accident rate of ducks. However, even ducks can misjudge their approaches and end up in the boondocks. They, too, goof up their rate of closure with their landing strips. They go through a lot of the same thinking patterns as you do in setting up a landing. The one big factor that they don't have to worry about though, is carrying enough power on their final to negotiate a go-around, if necessary. Now that you have received your wild life lesson, let's look into what is causing these costly undershoots.

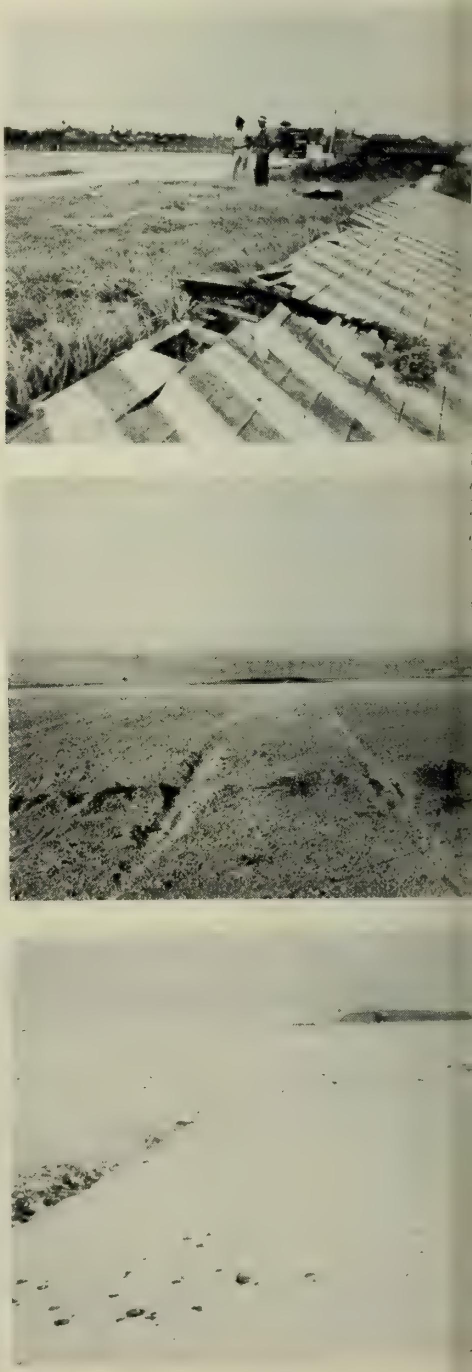
Faulty Rate of Closure

Topping the list is misjudged distance. Couple this with a faulty rate of closure with the runway and you and the duck are in the same predicament. Again, the duck is better off. All that he has to do is to dip his head downward a few inches and he picks up flying speed, pronto. Not so with you, if you're flying jets. If you are not carrying enough power to bring you to the threshold, then the back side of the power curve plus a high rate of sink is going to give you trouble in large quantities.

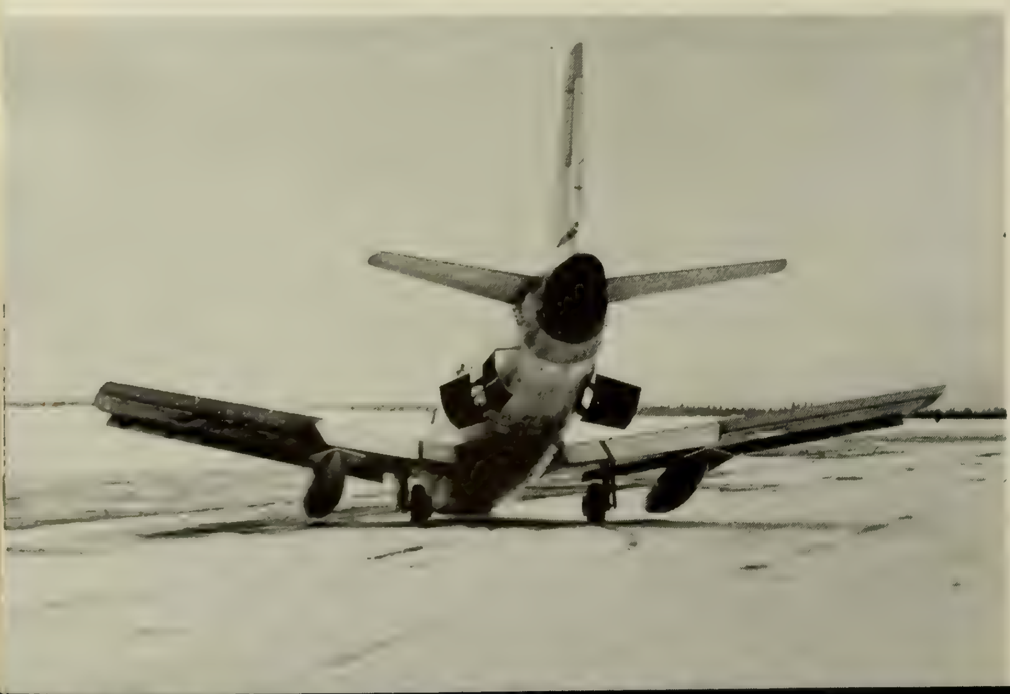
Strange as it may seem, in propeller-driven aircraft, it feels as if the airspeed jumps six to ten miles per hour when we apply the throttle when we are low on an approach. In reality, the increase in power results in increased lift provided by the propeller slipstream over the wings of the aircraft.

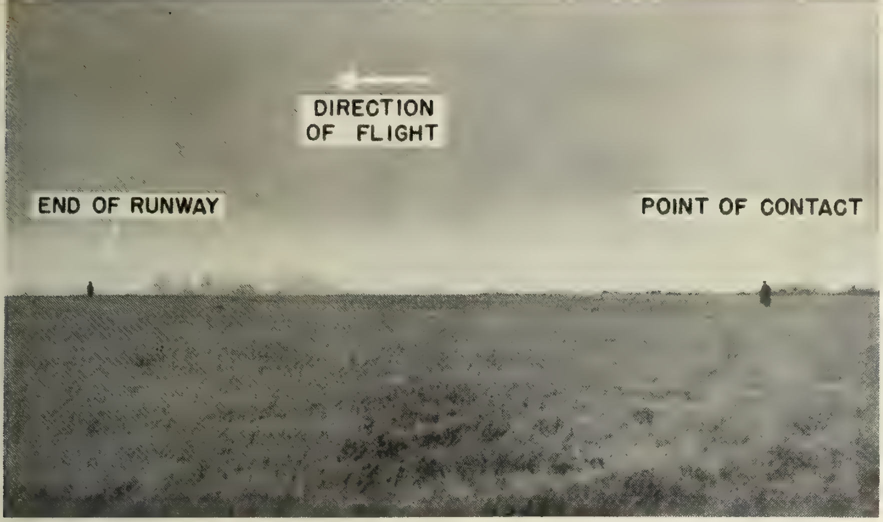
In jets, the situation is different. There is a five-to-ten-second lag from the time of throttle application to the

Tell-tale evidence of undershooting is shown below. Wooden warning barrier, sand overrun and snow, all show touchdown imprints.

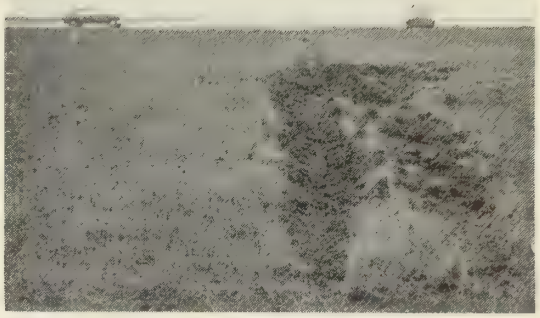


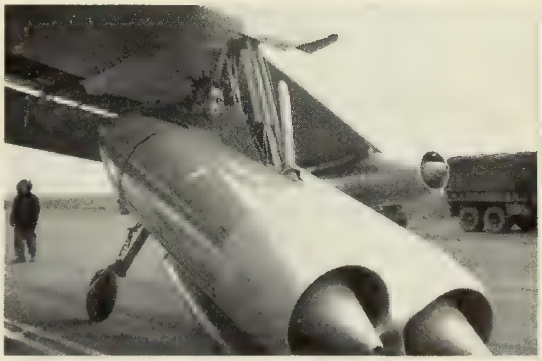
Too low on final. Above, main gear touched first in snow, forcing nose gear down. Slid 1500 ft.





The B-47 settled short of the runway. The left outrigger struck the soft ground causing the main left gear to roll in the dirt for 50 feet. The left outrigger doors contacted the runway during the last 300 feet of landing roll as the pods bend downward. Approach too low, flat.





response of power to gain a few additional knots of airspeed. It is this lag that accounts for many accidents.

Associated closely with misjudging distance as a cause factor is stalling, insufficient power or incorrect altitude. The drivers of jets outdo the reciprocal airplane guiders by a ratio of 30 to 1, in this category.

Failure to Level Off

Amazing as it may seem, failure to level off, roundout or flareout properly follows the stalling out cause factor in undershoot accidents. As one old timer has stated, "I don't know about this misjudging or stalling business. I think pilots have just stopped flying their aircraft while still on final. They say to themselves, 'Here I am, safely down from umpteen thousand feet'."

As if landing was not critical enough, getting into a stirred-up mess of air caused by jet or prop wash crops up as a cause factor. How long has it been since you've kicked rudder and . . . nothing? This sensation is a sure enough sweat-popper-outer. If you have any control over your landing sequence, don't be like the L-17 pilot who tangled with a B-36 slipstream. He resembled the proverbial sparrow caught in the middle of a badminton game.

Here are some other dudes in this field of human cause factors in undershoot accidents: Failing to compensate for wind conditions, failure to see collision objects, insufficient use of flaps and landing not aligned with the runway.

Cargo type aircraft have racked up some dillies in undershooting, but a slight change in traffic pattern has all but eliminated their bugaboo.

It used to be common practice for a transport pilot, calling in for landing instructions from an overwater flight, to ask for a straight-in approach. Then, PRANG! Wha' hoppen? Here's the answer.

Perception judgments resulting from long periods over water are misleading. The same thing applies to flights at night over terrain with no visible horizon. So the remedy in these cases is to circle the field one or more times. This permits a pilot's eyes to adjust to the local terrain features and allows depth perception to become normal. This circling procedure is mandatory now when landing at many bases.

What's the Solution?

Of course, there are other causes for undershooting. The ones covered here are some of the major areas. Like our capable physician who analyzes the probable causes of a sickness and then begins his remedial action, let's see what possible solutions are being studied to whip this undershoot problem.

One possible solution is painting a touchdown point 500 to 1000 feet from the approach end of the runway to serve as a landing target. This brings up two schools of thought.

The desire of a pilot to set an aircraft down on the first few feet of a runway is commendable as a demonstration of skill, but is expensive if an error in judgment or an emergency occurs. To set the aircraft down at the suggested touchdown point would demonstrate the same ability, while leaving an adequate margin for faulty calculation or any other unanticipated flight emergencies.

A rebuttal to this theory is that an attempt to train a pilot to land on other than the extreme end of the runway might establish a fixation that would be hazardous if he made approaches on shorter landing areas. It is possible that pilots will attempt to land on these designated marks or points regardless of altitudes or airspeed, resulting in an additional accident potential. And so it goes.

Some bases use frangible picket fences or small evergreen bushes in the overrun areas to act as deterrents against landing in this area.

Other bases use a runway mobile control unit and grade traffic patterns and landings of individual pilots of their organization. In line with this procedure, still other bases have expanded this idea to include the use of motion pictures of landings. The theory being that every pilot, knowing that his landing is being filmed, will concentrate upon doing the best job possible. By establishing sound flying techniques in the pattern, final approach and flareout, it is believed that a pilot will continue these behavior habits every time that he lands.

Wind-Shear Problem

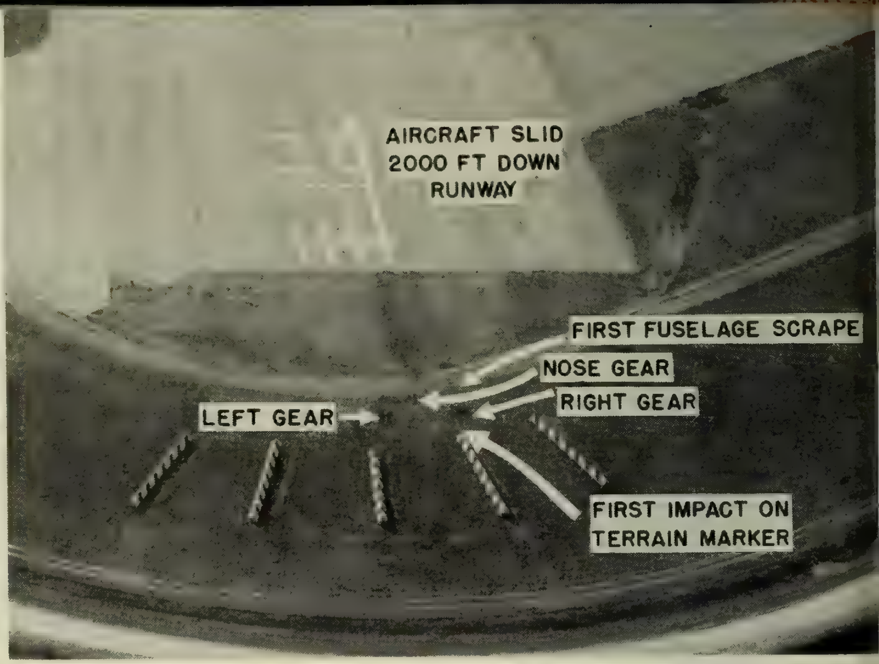
In addition to various solutions, another angle being studied is the wind-shear problem connected with landings. (FLYING SAFETY will treat this subject thoroughly in a future issue.) Briefly, a lot of unexplainable undershoot accidents point to this weather phenomena. A pilot can be coming in for a grease job, landing into a good reliable headwind, when zingo, he enters into a wind-shear area where the headwind changes into a tailwind and he's in for trouble. Pilots that say "I had it made" are absolutely right. They had it made and can't understand why they went into the ground.

A recommendation that might fit some if not all human cause factors is a program to indoctrinate all pilots in the limitations of their visual system in estimating distance, speed and rate of closure and the importance of taking these limitations into account in setting up a landing. Basically, this boils down to something like the automobile driver reaction series that show a driver how his depth perception and reaction time compare with the speed and stopping distance of his vehicle.

Secondly, emphasis should be placed on the necessity of maintaining adequate thrust until touchdown is assured, and that when indicated, a go-around can be initiated before minimum altitude is reached.

This whole package of undershooting needs constant vigilance right up to the threshold — whether flying VFR or IFR.

It's important to be in that magic area at the right airspeed in conventional type aircraft; it's a necessity in jet aircraft. ●


AIRCRAFT SLID 2000 FT DOWN RUNWAY
FIRST FUSELAGE SCRAPE
NOSE GEAR
RIGHT GEAR
LEFT GEAR
FIRST IMPACT ON TERRAIN MARKER

". . . the landing lights revealed the wooden embankment markers. The C-124 hit 170 feet from the end of runway, shearing nose and main gears."

". . . the airplane continued down the runway, sliding on its fuselage before it stopped. The pilot erred in his judgment and undershot the runway."

WELL DONE

Captain
George H. Normand

582d Air Resupply Group
RAF Station, Molesworth, Hunts, England

KNOWLEDGE ★ TRAINING

CAPTAIN GEORGE H. NORMAND and his C-119 crew completed a very thorough walk-around inspection. The local transition mission would be for four hours.

The copilot was making the takeoff from the right seat and the C-119 became airborne in an excessively nose-high attitude. Captain Normand, thinking that the copilot simply had overcontrolled the elevators, tried to help him lower the nose. To keep the nose down required extreme pressure on the yoke and when the aircraft did not respond to trim, Captain Normand advised the copilot to pull the autopilot emergency release.

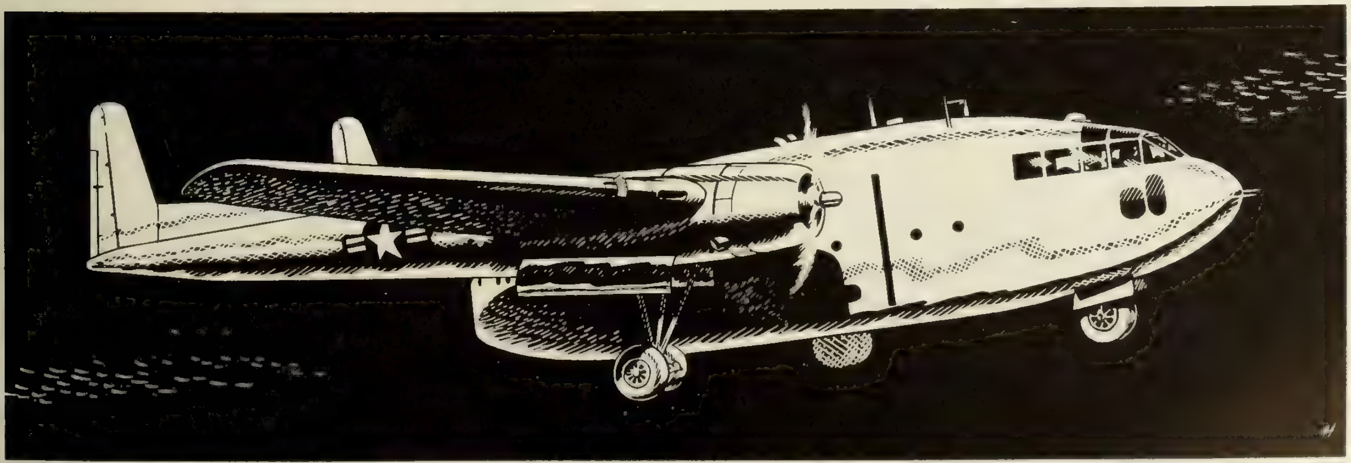
Despite all of the forward pressure that Captain Normand could exert, the big transport started to climb again. He called for the copilot, navigator and crew chief to help hold the control column forward and advised the radio operator to declare an emergency.

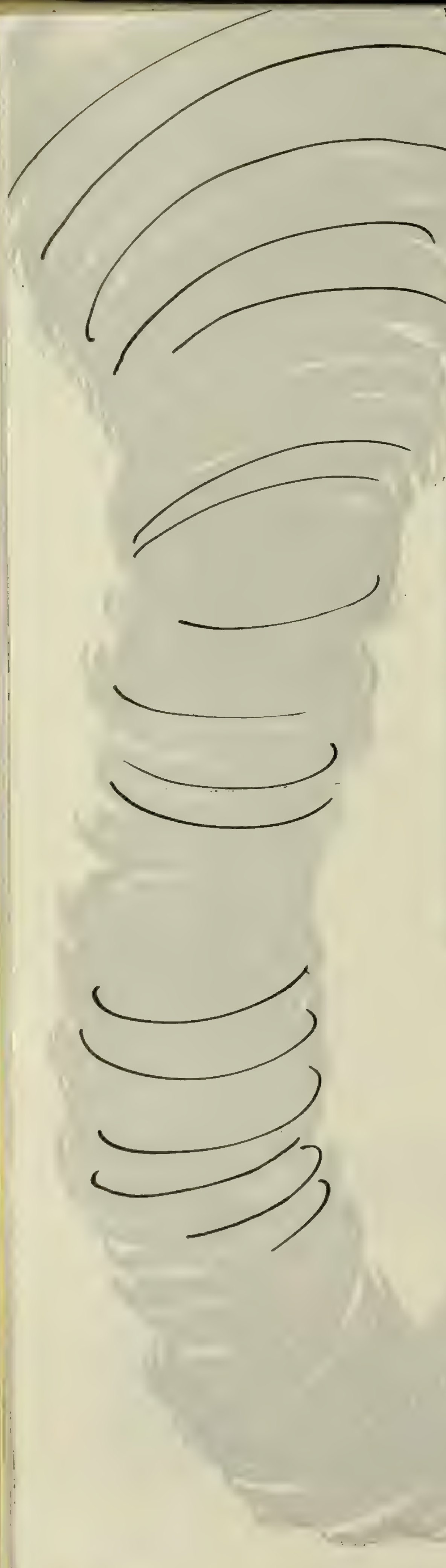
The landing gear was left in the down position to make the aircraft more "nose heavy." The crew chief tried to tie the control yoke forward with a tie-down rope. This failed. Unsuccessful attempts were made also to prop the yoke forward with a one-inch board. With both Captain Normand and the copilot bracing their knees against the control column, level flight could be maintained at 90 knots airspeed. They flew for 40 minutes in this manner. Aileron movement was impossible and only gentle turns could be made by Captain Normand, who used one foot at a time on the rudders.

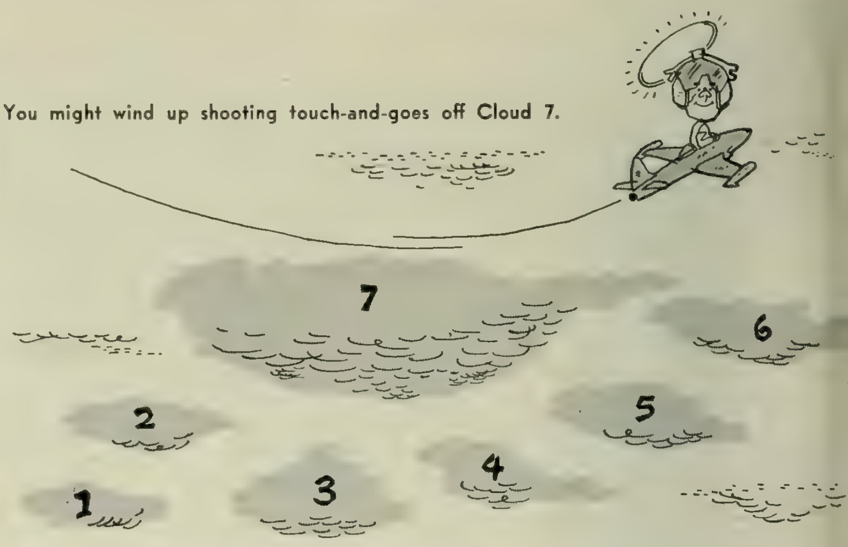
The crew voted in favor of remaining with the aircraft and with everybody assisting, the heavy C-119 was landed safely.

Inspection revealed that the elevator trim tab was jammed in the full nose-up position.

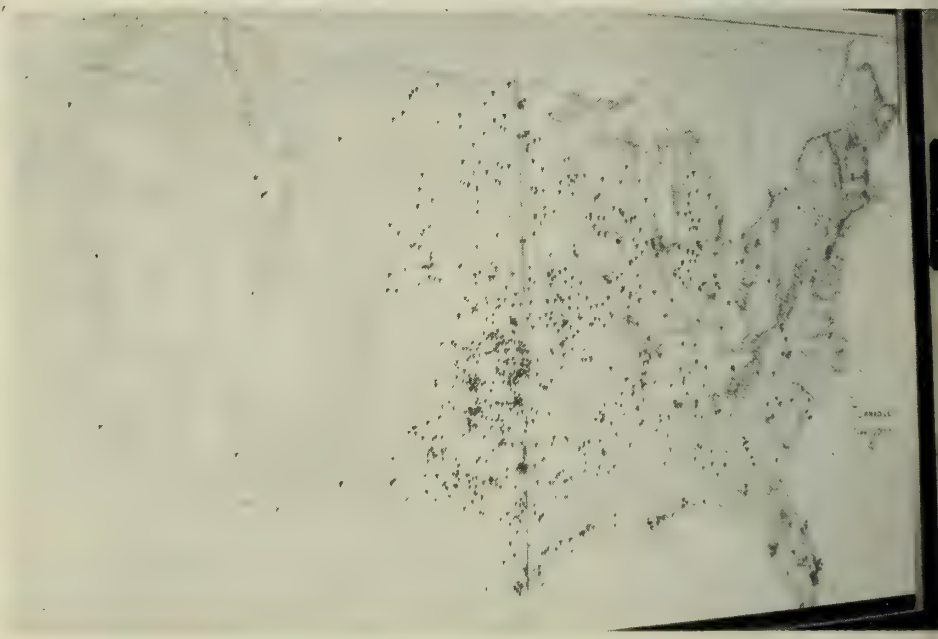
Good judgment, excellent knowledge of the aircraft's performance and a high degree of coordination and teamwork saved the lives of this crew. Well Done!







You might wind up shooting touch-and-goes off Cloud 7.



Dots show where tornadoes occurred. Central Plains area is "tornado alley." Plan your flight.

The tornado season is upon us. If you have no desire to tangle with one, perhaps this article has the answer.

Tale of the Twister

". . . he came nose to nose with the thing."

I BELIEVE IT IS SAFE to say that you have never flown through a tornado. You may have flown into one, but nobody, I mean nobody, has ever flown through one. Furthermore, of those who have merely flown into one, the vast majority are now getting their flying time shooting touch and goes off of Cloud Number Seven.

One exception to this is the incident involving Colonel H. R. Thyng and his flying machine. (FLYING SAFETY, July 1954.) Colonel Thyng unfortunately came nose to nose with a twister at some twenty odd thousand feet. Thyng entered the thing with a T-33 strapped securely in place. However, man and machine were torn every way, including loose, and the good colonel was spewed out the bottom of the twister, sans 33.

Now, all of this is not too difficult to imagine when one considers that the winds in and about a tornado range from zero to 300 plus mph. Also, figure that subject big wind may contain everything from young milk cows to old fence posts and things get kind of messy, especially for flying aircraft.

Actually, there is only one way to treat a tornado . . . steer clear of it. This is really not too difficult a task, provided you play your cards right. All that is required is to be somewhat familiar with the tornado frequency pattern, geographically and seasonally; and, most important of all, know about the service available to you through the Severe Weather Warning Center.

If it's any consolation, you can fly around Hong Kong about anytime and be reasonably sure that you will not tangle with a tornado, for 99 per cent of all tornadoes occur in these United States. Further, the chances of dancing with a twister in Walla Walla are almost as remote as in Hong Kong, for the vast majority of the beasties prowl around the central southern plains states and the southeastern states bordering the Gulf of Mexico.

The reason tornadoes occur in this more or less restricted area is easily explained. (That's what the man said.) It is simply that only in this area is required distribution of the weather elements, necessary for tornado formation, met with any frequency. The warm, moist air from the ground to eight or ten thousand feet is provided by the southerly flow from the Gulf of Mexico. The necessary over-riding, dry and cooler air is provided by the strong westerly flow across the Rockies. This precise sequence of events and elements is necessary to produce tornadoes and in no other area in the world is this sequence met so often.

Seasonal variations are almost as well defined as the geographical variations. The zone of maximum tornadic activity starts in the southeastern states in February and shifts northwest during March and April. In May and June, the center is in Oklahoma, Kansas and Iowa. After October, tornado occurrence declines very rapidly. The cycle then returns in February, starting in the southeast, and here we go again.

Now that you are soundly indoctrinated on the general tornadic situation, let's get specific.

There is a special kind of teletype sequence available in your base weather station. It is prepared by a group of Air Weather Service experts

Severe weather warning expert, Major Robert Miller, started forecasting twisters in 1948.

"...he was spewed out the bottom, sans 33."

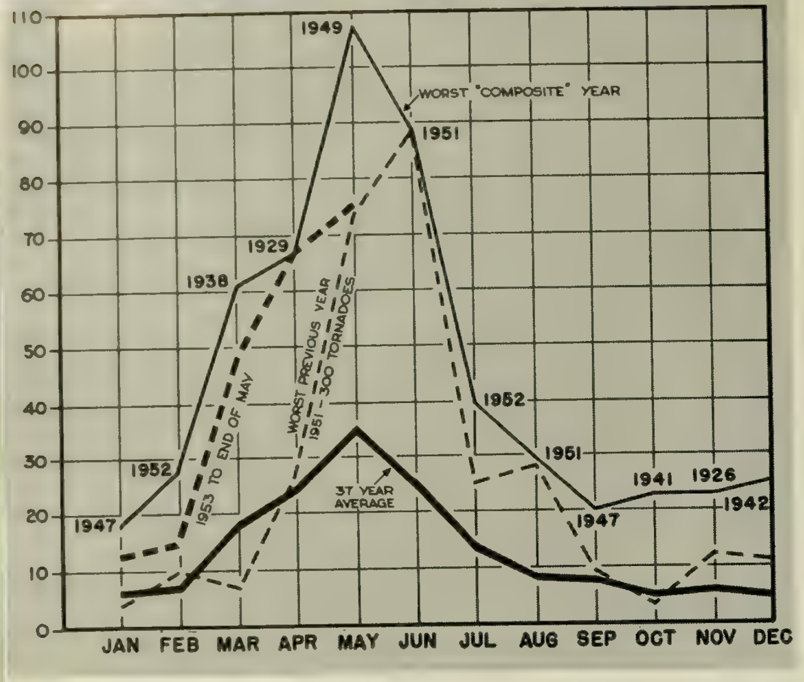
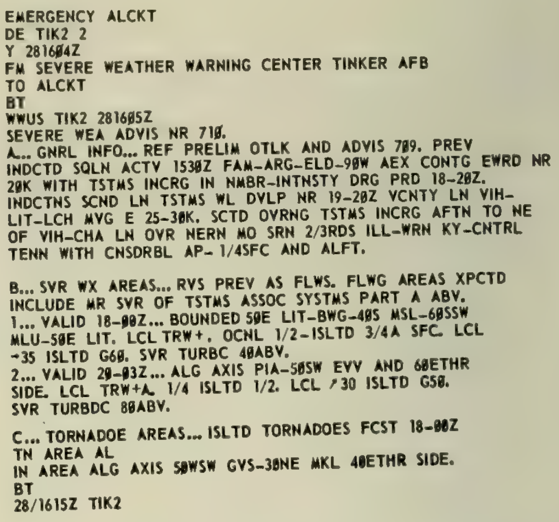


Chart shows monthly tornado frequency from January 1926-May 1953.



```
EMERGENCY ALCKT
DE TIK2 2
Y 281604Z
FM SEVERE WEATHER WARNING CENTER TINKER AFB
TO ALCKT
BT
WWUS TIK2 281605Z
SEVERE WEA ADVIS NR 710.
A... GNRL INFO... REF PRELIM OTLK AND ADVIS 709. PREV
INDCTD SQLN ACTV 1530Z FAM-ARG-ELD-90W AEX CONTG EWRD NR
20K WITH TSTMS INCRG IN NMBR-INTNSTY DRG PRD 18-20Z.
INDCTNS SCND LN TSTMS WL DVLP NR 19-20Z VCNTY LN VIH-
LIT-LCH MVG E 25-30K. SCTD OVRNG TSTMS INCRG AFTN TO NE
OF VIH-CHA LN OVR NERN MO SRN 2/3RDS ILL-WRN KY-CNTRL
TENN WITH CNSDRBL AP- 1/4SFC AND ALFT.

B... SVR WX AREAS... RVS PREV AS FLWS. FLWG AREAS XPCTD
INCLUDE MR SVR OF TSTMS ASSOC SYSTMS PART A ABV.
1... VALID 18-00Z... BOUNDED 50E LIT-BWG-40S MSL-60SSW
MLU-50E LIT. LCL TRW+. OCNL 1/2-ISLTD 3/4A SFC. LCL
-35 ISLTD G60. SVR TURBC 40ABV.
2... VALID 20-03Z... ALG AXIS PIA-50SW EVV AND 60ETHR
SIDE. LCL TRW+A. 1/4 ISLTD 1/2. LCL /30 ISLTD G50.
SVR TURBDC 80ABV.

C... TORNADOE AREAS... ISLTD TORNADOES FCST 18-00Z
TN AREA AL
IN AREA ALG AXIS 50WSW GVS-30NE MKL 40ETHR SIDE.
BT
28/1615Z TIK2
```

Fig. 1. A severe weather advisory sequence looks like this.

who forecast all severe weather, up to and including tornadoes. This outfit is headed up by Major Robert C. Miller, undoubtedly the champion tornado and severe weather forecaster in the United States. He and his boys have been forecasting twisters with amazing accuracy since 1948.

When they say that there is going to be a tornado within a specific area, batten down the hatches. Eighty-one per cent of the time they are right. They can forecast a tornado within a 150-mile area, 88 per cent of the time and when they forecast a thunderstorm, they miss only once out of a hundred times.

Now when you have an outfit like this going for you, it's downright dereliction of duty not to make use of their services.

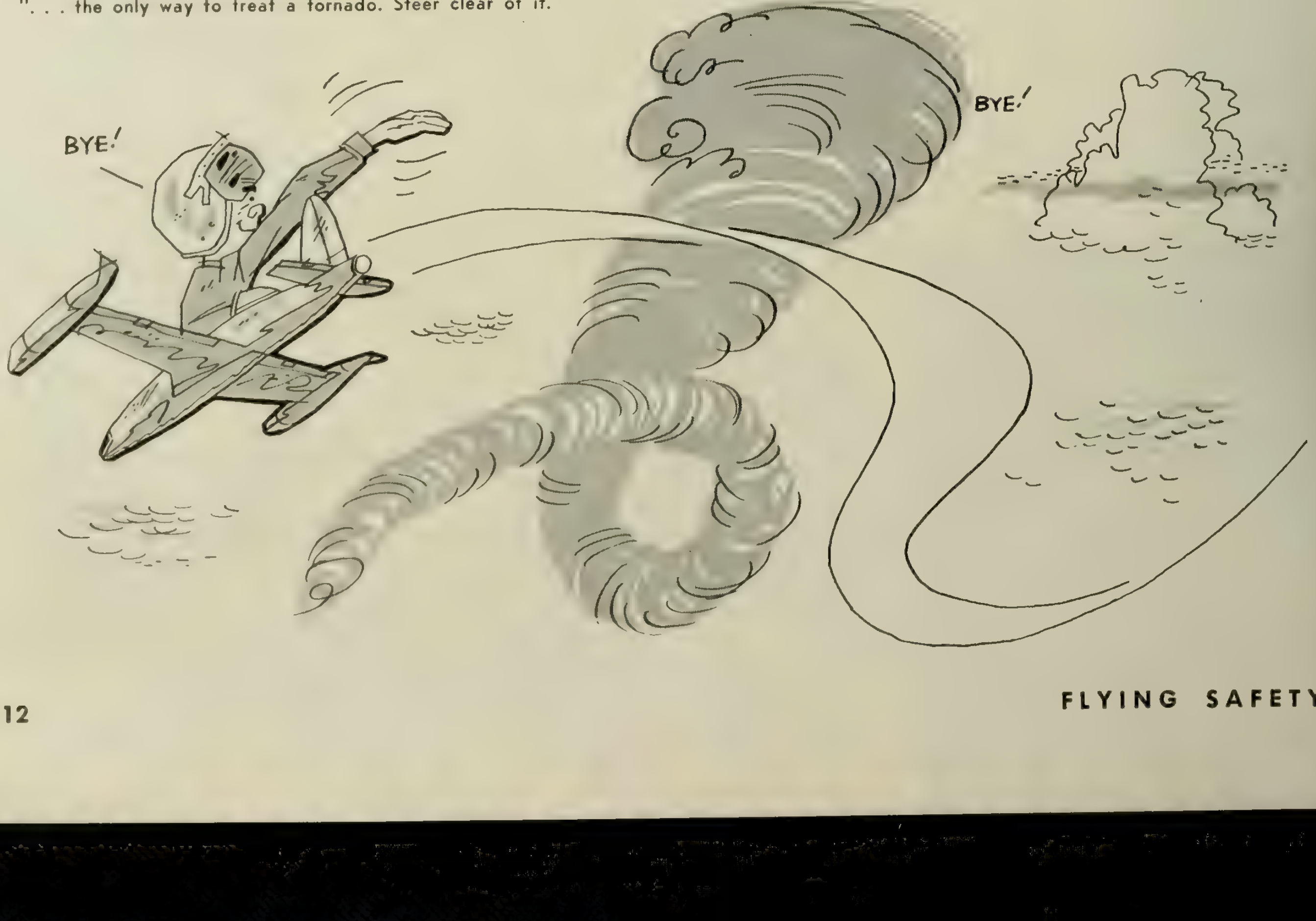
During tornado season, a number of these special teletype sequences are sent out each day. The first one carries a preliminary outlook for the day, and the frequency of subsequent reports depends upon the situation.

The Severe Weather Warning Center sequence is composed of four sections. The first (A) gives general severe weather information. The second (B) outlines the actual severe weather areas, not to include tornadoes. The third part (C) gives the tornado areas and the fourth section (D) carries any remarks.

Figure 1 is a reproduction of an actual SWWC sequence report. If you are unable to read this type of report, don't worry about it. Just be sure to ask the man who sits in your base weather station. He will decipher it for you.

The twister season is just about on us, so consider yourself warned. If you care to tangle with one, "Be my guest," (but please, not in Uncle Sugar's airplanes). If you don't, just read and heed those Severe Weather Warning Center sequence reports. ●

". . . the only way to treat a tornado. Steer clear of it."



Keep Current

NEWS AND VIEWS

New Console—Control tower operators at Air Force bases soon will have a more efficient control console from which to perform their duties.

The new console, called the Universal Control Tower Console, enables tower operators to control runway lighting, keep posted on weather information, log flight plans, maintain radio contact with aircraft and keep in touch with the radar approach control station or other control agencies in their operating sector.

Destined to become standard equipment, it was designed and built by engineers of ARDC. It can utilize high or low frequencies, VHF or UHF. It can be adapted to any future navigational aids. ●

★ ★ ★

Record Flight—McDonnell Aircraft Corporation's experimental "convertiplane" smashed the world's speed record for helicopter type aircraft on its first conversion flight. The XV-1 embraces a new concept of flight, combining the vertical flight characteristics of a helicopter with the speed and range of a conventional fixed-wing aircraft. An overhead rotor similar to those on helicopters is used for vertical flight. A pusher-type propeller and the aircraft's wings permit forward flight. The rotor is driven by pressure jets — one at each tip of the three blades. The aircraft recorded a speed of 120 mph. ●

Below, personnel of a pilotless bomber squadron prepare to perform a simulated launching of a TM-61 Martin Matador missile somewhere in Europe. Right photo shows some major parts on production line.

Alphabet Soup—Effective 1 March 1956, five letters in the phonetic alphabet will change. The words Cocoa, Metro, Nectar, Union and Extra will be changed to Charlie, Mike, November, Uniform and X-ray.

These changes will be adopted and implemented within USAF for use in all communications. All commands will be directed to use the new ICAO phonetic alphabet. ●

★ ★ ★

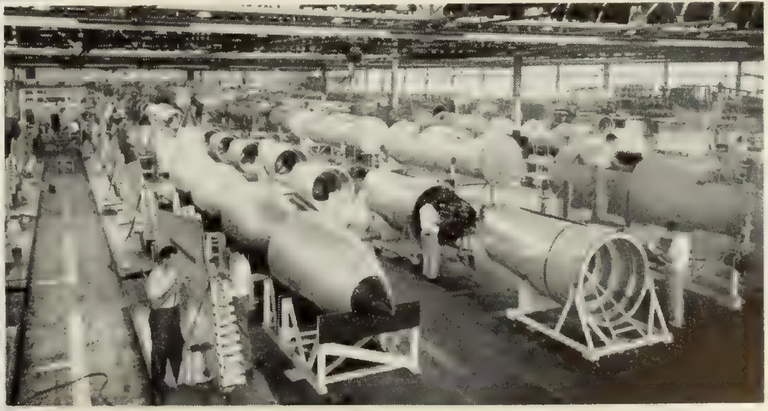
Automatic Computor—The first engineering model of "Air Traffic Control Central" is undergoing tests at Clinton County AFB, Ohio. Popularly known as Volscan (FLYING SAFETY, April 1954), this model includes equipment that will provide automatic control instructions for 14 aircraft simultaneously.

In 1952, automatic tracking and computing equipment first was tested. Six experimental channels provided approach instructions for six aircraft arriving at approximately the same time. More than 2600 actual flights by test aircraft were made to determine the accuracy of the automatic equipment.

These current tests will be aimed at improving the rate at which aircraft can arrive safely at an airport. This rate is improved when control instructions are computed automatically for the operator.

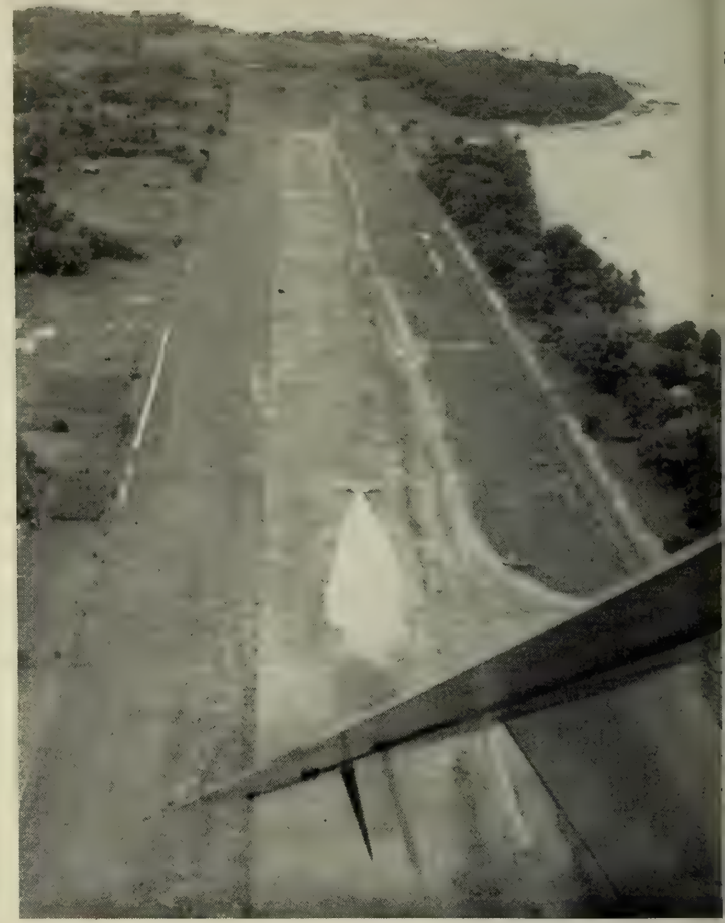
The equipment selects for each aircraft the earliest possible time of arrival which is consistent with the speed of the aircraft and which does not conflict with other planes already scheduled. An automatic coupler then continually computes control orders for each aircraft so it will arrive on schedule within a precise interval.

The computor accomplished this spacing by "heading" control, which is the automatic issuing of minor offset headings for the aircraft to fly when it is necessary that it be delayed. ●



The problem. How to get the four F-84s off the old fighter strip? The decision. Fly the aircraft out, using JATO on takeoff run. Right, ". . . he cut the bottles in a third of the way down the strip."

ONE TWO THREE . . . . BLOOP



Here is an example of how knowledge through training saved an aircraft and probably the pilot. You may say that number four man was just plain lucky. But it's amazing how knowledge of your aircraft and emergency procedures contribute to "luck" when the chips are down.

LAST SUMMER, WE HAD an incident occur here that may be unique in the Air Force insofar as jet short field takeoffs go. It all started when a flight of four F-84Gs were unable to land at Clark Field after a sudden rainstorm developed and the ceiling dropped to 300 feet, with ½ mile visibility.

The flight attempted to hold, in a clear area, until the storm passed, but fuel became critical. A landing had to be made immediately, and the flight leader took his boys over to Poro Point, an old, abandoned fighter strip. He dragged the field and then went in and landed. The rest of the flight followed; all four planes got down without even a blown tire.

Now this, in itself, was a fair accomplishment as the strip was composed of gravel and old asphalt, and was only 3936 feet long. But, although the aircraft were landed safely, another problem loomed ahead. How were the four fighters to be recovered?

After some discussion, a decision was made to fly the aircraft out, using Jato on the takeoff run. And right here is where things got real hairy.

After the Jato bottles were installed, the four F-84s taxied to the end of the strip and ran up to 100 per cent.

Above, ". . . the F-84 gained speed rapidly with the white plume trailing behind it." Below, ". . . at the last moment, he pulled heavy F-84 off."

A C-47 was parked approximately ⅓ of the way down the strip, and each pilot was to cut the Jato in when he reached this spot. The first three planes got off without incident, but the fourth pilot ran head-on into trouble during his takeoff roll.

By the time he reached the C-47, the aircraft was moving at a good clip, but when he cut in the Jato, nothing happened! The bottle didn't fire. The pilot was faced with two choices: abort, or try to fly the plane off. He chose the latter and held the plane down until the last second and then horsed it into the air. The aircraft became airborne and staggered over a 55-foot hill which was immediately off the end of the runway. As he came across the hill, he dumped the nose slightly and let the plane settle a little until it was about 15 feet above the ocean. Gradually, the airspeed built up and the pilot was able to climb and join the rest of the flight. It couldn't have been closer, and I doubt if many F-84 drivers have taken off in a much shorter distance and cleared better than 50 feet. Incidentally, the runway temperature was 91 degrees, and don't discount the rough runway surface, which didn't help the takeoff roll a bit. ●

"Nothing"

• • • • • • • • • •

can be dangerous!

Colonel K. E. Pletcher
Commander, USAF Hospital, Carswell AFB.

FLYING SAFETY is indebted to Col. Pletcher for preparing this article. The story originally appeared in "Combat Crew," a publication directed toward the combat crewmen of our Strategic Air Command. The article has been reprinted in several base and command publications; however, FLYING SAFETY feels that information such as this cannot be repeated too often.

You can get tired doing a lot of almost nothing. Far left photo—heavy flying clothing and cramped working space induces fatigue. Pilot, left photo, shows effect of static fatigue induced by little exercise. Above, exertion produces dynamic fatigue. Tiredness leads to inefficiency.

CAN YOU GET TIRED from doing almost nothing? This question is not facetious. Its simple, correct answer "Yes" is at least partly, and may be completely, the explanation for a number of aircraft accidents. These accidents have cost the Air Force millions of dollars, and what is infinitely more important—lives. Your own continued well-being may depend on an understanding of the peculiar type of fatigue which is an occupational hazard to any pilot or aircrewman.

It is not difficult to understand feeling sleepy, following lack of sufficient rest. It is not difficult either to imagine being tired after a game of basketball or 18 holes of golf. It is much more difficult to accept the fact that you may be so tired as to be dangerously inefficient after a prolonged period of relative inactivity. Such, however, is the case. It just doesn't fit the generally understood picture of how you get tired.

Tiredness or fatigue, in all its aspects, is a complex entity and does not lend itself easily to pat scientific explanation. We can consider it, however, in practical terms which will serve the purpose of this discussion. In these terms then, what is fatigue? It is a physiological state of tiredness, exhaustion or lassitude which may or may not cause its victims to be aware of its presence.

True or False

There is a kind of fatigue which may be called subjective or "apparent" fatigue. This is a mental fog which may cause you to comment, "I feel tired." Almost everyone has experienced it. It is usually brought on by boredom but actually has no physiological or chemical basis. It disappears rapidly and completely under the stimulation of interest or attention to tasks at hand. This may be called false fatigue, for it is really a state of mind rather than a condition of the body. The other kind of fatigue is true fatigue. This is a physiological state, and the result of changes in body chemistry and physiology; therefore, it cannot disappear or be dissipated under the stimulus of interest or attention. This is the fatigue which is significant and can be very dangerous.

True fatigue can be produced in either of two ways. One way to produce it is by hard or prolonged physical effort. This is familiar to everyone who has participated in active sports and is easy to understand. The other way that true fatigue can be produced is less understandable. This is the production of fatigue by inactivity or stasis such as is encountered on long-range aerial missions during which very little physical activity is possible. Named by the way it is produced, the first type of true fatigue may be called "dynamic fatigue" and the second type is called "static fatigue."

Cause Factors

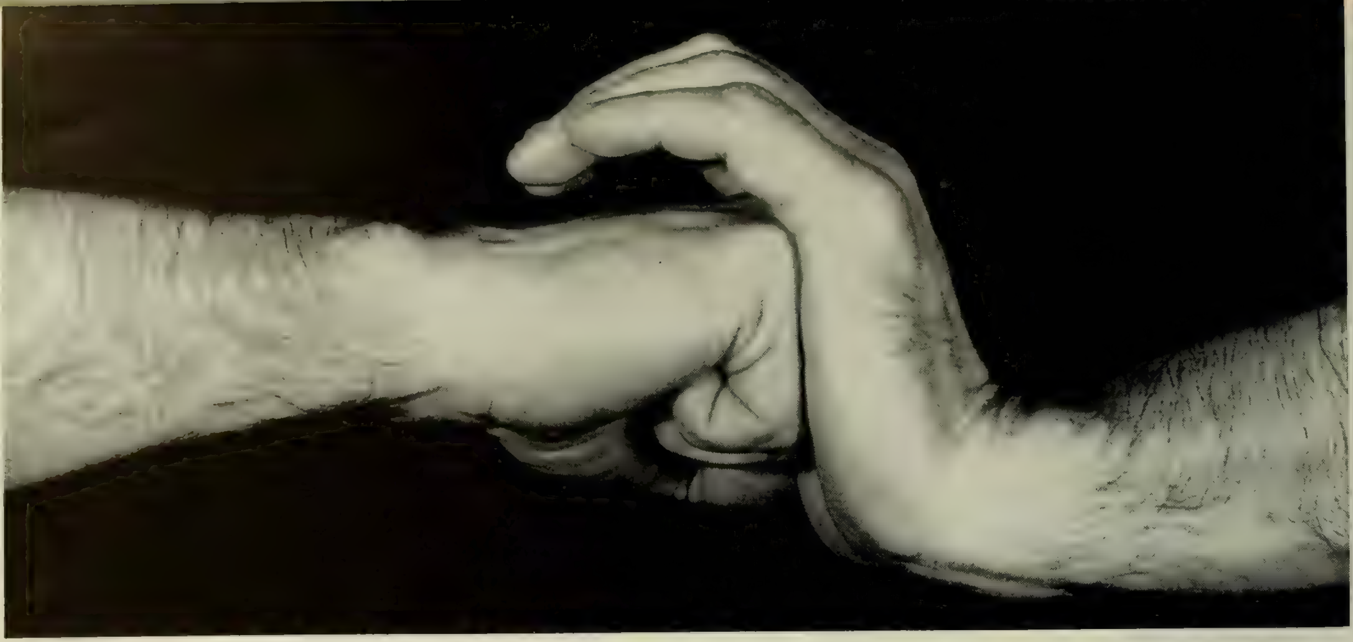
To repeat, true fatigue can be produced in two ways: by physical exertion—dynamic fatigue; by lack of physical exertion—static fatigue.

This is a paradox, but it is correct. Since we easily can understand cause and effect in dynamic fatigue we shall consider, from this point on, static fatigue alone through a series of questions and answers. Remember that both dynamic and static fatigue produce similar changes in body chemistry and hence in physiology and effective function.

How does static fatigue develop? Static fatigue is slow to develop and is insidious in onset. Consequently, individuals so fatigued may not realize they are functioning way below par. Although other factors may be present in producing this type of fatigue, the principal causes are:

- Lack of adequate preflight rest. In this case some static fatigue is present at takeoff.
- Long "time-out-of-bed" prior to takeoff. This aggravates any effects of too little rest.
- Inadequate inflight rest. In multiplace aircraft this means relief from crew duty and sleep. It is quite dif-

Staying in shape is one way to fight fatigue.



During long flights, take "antagonistic muscle" flexing type of exercises often.

ferent from lack of physical activity while awake and performing necessary crew duty.

- Very little physical activity. This results in lowered body metabolism, fewer and shallower respirations, slowed circulation and a relative stasis of body fluids. The combination of these causes waste products to pile up.
- Prolonged exposure to a very dry atmosphere. The relative humidity of pressurized aircraft cabins at high altitude is remarkably low. This results in a large loss of fluid from the body. There is an apparent loss through urination. Less apparent, or not apparent at all, is a large loss of fluid through perspiration and respiration. In the dry cabin atmosphere perspiration evaporates rapidly and you may lose, in a 24-hour period, as much as two quarts or more of water just by perspiring and breathing. No sweat, eh?
- Loss of salt without adequate replacement. This occurs principally as a result of perspiration.
- Prolonged exposure to relatively low oxygen tension. In other words, there is present in everyone a mild but significant hypoxia.
- Prolonged exposure to noise and vibration. All aircraft, to a greater or lesser extent, expose their occupants to mixed frequencies and intensities of noise and vibration. Over a number of hours such exposure contributes considerably to the development of static fatigue. This is in spite of the fact that pilots and other aircrew members are accustomed to these exposures and do not particularly notice or become disturbed by them.

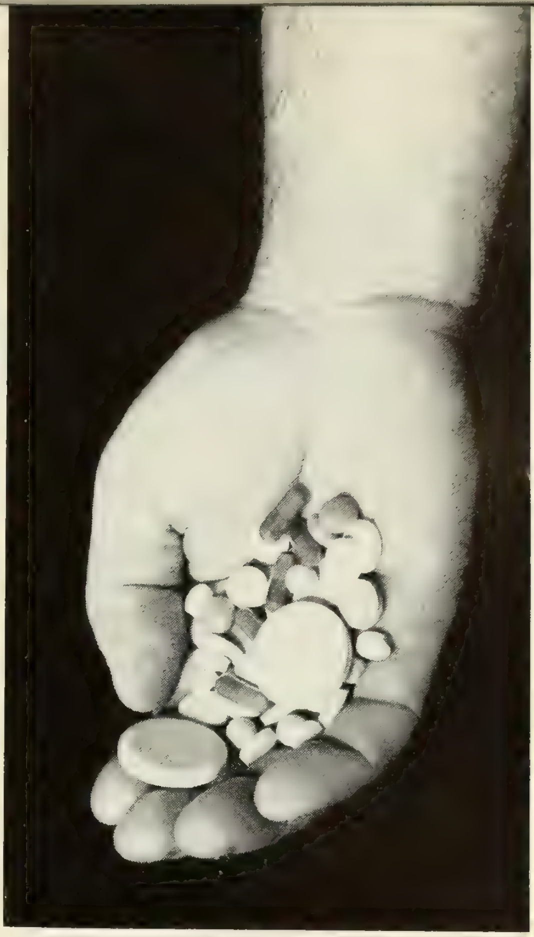
What does static fatigue do to you? In non-technical terms, it will:

- Make you feel drowsy, irritable, bored, or all three.
- Make you less attentive to what is going on around you.
- Make you drowsy in a very insidious sort of way. This may be observed by suddenly waking to an awareness of your surroundings without knowing that you have dozed off to sleep.
- Cause you to adopt a "So What?" or "Let it drift" attitude. This is a state of contentment with things as they are and a reluctance to alter the status quo.
- Make you slow to react to rapidly changing situations.

It is needless to elaborate on the

To assure ample fluid intake, drink water, milk, fruit and vegetable juices.

Scheduled rest periods for all crewmembers is possible in large aircraft.



Routine use of drugs is dangerous.

danger of any one or any combination of these effects of fatigue as they relate to flying. Critical phases of flight demand maximum attention, relaxed alertness and the ultimate in crew coordination to insure safe and effective operation. It requires little imagination to visualize what could happen when even one key crewmember is ineffective as a result of any of these things.

Preventive Action

What can you do to prevent or overcome static fatigue? There are a number of things which are effective both in preventing and combating static fatigue. Perhaps it is best to list them and discuss each, briefly:

- Assure adequate preflight rest. Get at least eight hours of sleep prior to a long flight.
- Make all efforts to have a minimum "time-out-of-bed" prior to flight. This is admittedly a difficult thing to control, but improved operational techniques and practices can insure that this time will be minimal.
- In multiplace aircraft, schedule rest periods for all crewmembers during long flights. This is a matter of crew discipline and many times is dependent on the leadership abilities of the aircraft commander. We have found that properly suspended hammocks afford the best means of inflight rest. Hammock occupants, too, are relieved from the tiring effects of vibration during their periods of rest.
- Take muscle flexing or "antagonistic muscle" type of exercises several times during long flights. This type of exercise is similar to that advocated by various people in the muscle building business. It is based on the fact that almost every muscle in the body has an antagonist. Thus, you may attempt to flex the forearm at the same time resisting this movement by tensing the muscle at the back of the arm whose action is to straighten or extend the forearm rather than flex it. Another such exercise consists of placing the fist of one hand into the palm of the other and pushing while resisting the push with the open hand. Another is "walking in your shoes." This consists of moving the toes of each foot alternately as though walking barefoot. Tense and relax thigh muscles alternately. These exercises, which may be performed in very limited space, tend to overcome stagnation of body fluids and assist in alleviating fatigue.
- Assure ample fluid intake. The drinking of water, milk and especially canned vegetable and fruit juices is most desirable. These provide a much needed replacement of water, sugar and salt throughout the period of flight. Tea and coffee, while providing fluid, perhaps sugar and stimulation, are diretic and cause the loss of more fluid through relatively increased urination.
- Eat small amounts of solid food at more frequent intervals rather than eating large amounts at one time. This eating habit can be acquired during flights and is eminently more satisfactory than the ingestion of a large meal which accentuates the effects of fatigue.
- Breathe 100 per cent oxygen for several separate five-minute intervals during the last 30 or 45 minutes of flight or prior to other critical phases of flight. This increase in the percentage of oxygen breathed will help the body tissues wash out the piled-up waste products and greatly facilitate both mental and physical activity.
- Don't use drugs. All of us perhaps are unwilling to exert an effort we think a pill will accomplish for us. Drugs are mentioned only to advise against their routine or habitual use. The effects of the same drug are varied among different individuals as well as in the same individual on different occasions. Thus, predictability of reaction to drugs of this nature is poor and their use may be dangerous rather than helpful. For maximum effort or all-out missions, specific drugs might be considered for use under strict medical supervision. Routinely, no.

Remember that you can get tired doing a lot of almost nothing. Remember that you may not be aware you are tired. Remember that this tiredness—a true fatigue—can render you dangerously inefficient as a combat crewmember. You can and should do something to prevent or overcome this peculiar occupational fatigue of pilots and aircrewmen on long missions. ●

REX SAYS

THE WAY I figure this predicament of being disoriented, misplaced or lost is just to come right out and admit it. Let a DF station get a fix on you. Then they can inform Flight Service of your plight and together, they probably can get you down safely.

At least that is what I did a while back and I thought Rex might be able to pass the word to some other poor timid soul who might be ashamed to let somebody know that he is roaring around the area not knowing exactly where he is.

Anyway, I was somewhat uncertain of my position and had only 20 minutes of fuel remaining. I called what I thought was the nearest control tower for assistance. The operator gave me a heading to fly and meanwhile alerted Flight Service. By doing this, another tower in the vicinity very comfortingly horned in and made contact with me.

I checked my fuel and about this time I thought that I was going to have to get ready to "leave home." Just then, I was advised that I should have the airfield in sight ahead of me. Sure enough, there it was. I landed and checked the fuel. There was less than five minutes remaining.

As I said previously, I figure that by telling somebody that I was lost, instead of hem-hawing around about it, I got down safely.

REX SAYS*—You figured correctly. There certainly isn't any stigma attached to saying you're lost, if you are lost. This DF procedure has saved many necks as well as expensive flying machines.*

"Be sure to write up OUR hard landing, Gridley."

I AM A PERSONAL equipment officer at my base. I've fitted many a pilot with an oxygen mask and am well acquainted with the paragraph of AFR 60-16 which delves into the use of oxygen. So when I hitched a ride on this B-25 one night going back to California, I was interested in seeing how the crewmembers complied with the reg.

Incidentally, for those of you who have the idea that you can over-use oxygen, I have discussed the pros and cons about using 100 per cent oxygen, with medical people. It seems that a guy would have to breathe it continuously for several days before any toxic effect would show up.

Anyway, I sat up front with the crew chief and as luck would have it, there was an oxygen mask hooked in near my seat.

I saw the look of surprise on the crew chief's face as I strapped the mask on after I had fastened my safety belt.

We took off and climbed to 12,000 feet before leveling off to cruise. I lounged back. Neither the pilot nor copilot made a move to strap on their masks. I noted that their individual masks were connected and accessible.

Throughout the flight, I noticed heads begin to nod as the pilots fought sleep. I thought to myself, "A little whiff of oxygen would help out about now." I kept a wary eye on them just to make sure that they both didn't conk out simultaneously.

Five hours later, I heard the tower operator give them their final landing instructions.

I remembered a statement that I often make to pilots. "The use of 100 per cent oxygen for 15 minutes during the last hour of a long flight is recommended, especially at night. It increases visual acuity and also their depth perception."

Well, neither pilot even looked at his oxygen. The landing itself was a bit bouncy.

Over a cup of coffee, I chanced a remark about their not using oxygen for I know that they saw that I had been using it. The reply? "No sweat in a B-25. Never even think of it most of the time."

So be it. But these type jokers should wise up if you ask me.

***REX SAYS**—Wonder how many non-oxygen users there are tooling around the night skies? Under certain conditions oxygen is a must. And* in a B-25. Never even think of it.

★ ★ ★

A BUDDY AND I were heading home from a navigational proficiency flight in a T-33. Just as we arrived over the high cone, we overheard a pilot contact the tower for a UHF/DF steer, but the tower did not have UHF/DF equipment.

The pilot was trying to describe the airfield below him. He was telling the tower the number of runways, the headings of the runways and the general layout of the field. However, there were several airfields in the vicinity that conformed to the description being given by the pilot and the tower was unable to assist him.

We had obtained our clearance and had started our penetration when it occurred to me that we might be able to give the lost jockey a steer with our airborne UHF/DF set (ARA-25).

We called the tower and volunteered our assistance. The pilot gave us a short count and we obtained a relative bearing on the aircraft prior to beginning our penetration turn.

We gave the pilot a heading to fly and upon completing our penetration, entered traffic for a normal landing. Since the pilot had not sighted the field yet, we gave him another steer while we were on initial. This second steer was just prior to pitch-out and we were not certain of its reliability. In order to confirm our second steer, we provided a third steer during the landing roll. The pilot sighted the field while we were taxiing in.

***REX SAYS**—This deed for the day puts you at the head of the class. Familiarity with and proper use of equipment stamps you and your buddy as being "professional types."*

REX SPECIALS

AIR TRAFFIC CONTROL surveillance radars are equipped with moving target indicator features, but these features do not permit radar to see aircraft during heavy precipitation. Thunderstorm showers and wet snow cause "radar clutter" to such an extent that air traffic control capability sometimes is limited severely. Maintaining radar identification of aircraft under these conditions can be difficult.

Some pilots have developed a false sense of security when being controlled with radar because they are not aware of this limitation.

★ ★ ★

"WHO INVENTED UHF radio, anyway? I never had any trouble with VHF." How often have you heard that statement during sessions of hangar flying? I have heard a lot of it, and I feel that perhaps a little discussion of the facts might help to cool off some hot tempers and frayed nerves.

Every radio, even your Dick Tracy wrist radio, needs an antenna. UHF radio operates something like an electric eye. For all practical purposes the receiving antenna must be able to see the transmitting antenna. Now if you go out to the ramp and put your eye in the same location as the UHF antenna on your aircraft, the chances are that you cannot see the tower. If that antenna cannot see the tower's antenna (which could be in a different location than the tower), you cannot talk to control personnel. This may not be completely true on the ground because the signals are so strong that they often bounce off hangars and find their way between antennas. However, there are no hangers in the air (ordinarily) and you must have line of sight to have communications.

Now, airborne antennas are located in different places on different aircraft and if your antenna is in the tail-cap you cannot communicate when the fuselage is between the tail-cap and the ground station. If you have a belly antenna you cannot communicate when turning into the station. You must remember also that every ground station has a cone of silence, therefore, you cannot swap talk while directly over a ground station.

So much for line of sight troubles. Now, what can be done today? Recognize the limitations and the equipment becomes quite adequate. Do not try to make contact while in a position which shields the antenna and you will remain calm and satisfied with your equipment.

There is also an "ace in the hole" which many pilots do not realize. Your VOR receiver is a fine VHF communications set. Simply tune in the desired tower or GCI frequency on the omni-control box and you can hear ground instructions clearly.

The UHF problem noted here has not been overlooked by the boys at Wright-Patterson Air Force Base. The Communications and Navigation Laboratory has an extensive program in effect, to solve this problem, but until the solution arrives in the field, be sure that you know the limitations of your equipment. This is the only way to get the best use. ●

OFF and RUNNING

Every takeoff is different. Knowing your airplane and what to do in case of emergency are "musts." Keep these in mind.

Bob Hoover, Test Pilot, North American Aviation

THE BEST insurance available to a pilot is a complete knowledge of the airplane he is flying, its capabilities and its limitations. Takeoffs are a particular source of accidents. Here are some things to keep in mind when you point the nose of your F-86 down the runway.

Flight Control System

With the advent of the hydraulic flight control system, some accidents occurred because pilots were unfamiliar with the new system. They did not realize that a heavier pull force was required at low speeds if the airplane was out of trim than on airplanes with a conventional flight control system. This is because the stick force on airplanes with the irreversible hydraulic flight control system remains the same regardless of the air load on the control surfaces.

However, when flying an airplane with hydraulic flight controls, you should remember that you always have control even with a runaway trim in the full forward or aft direction. The force required to maintain control is always within the capabilities of the pilot. This does not mean that the airplane should be flown if an obvious trim failure is known. However, should the trim run away during the takeoff roll at a point where the airplane could not be safely stopped, there would be no particular problem in taking off and making a normal landing.

When briefing pilots, I have recommended the following check prior to the next flight. With the engine running, or an external source of power plugged in, run the trim full forward and visually check the stabilizer position while pulling the stick full aft, noting that full travel can be obtained.

Many pilots have been taught that if the airplane is held in a three-point attitude during the takeoff run for a prolonged time, the airplane will arrive at a negative angle of attack and cannot be taken off. This is not true. Again, it is a matter of understanding the flight control system in F-86s.

Everyone realizes that a very small stick movement maneuvers the airplane quite well at 400 or 500 knots. Yet, at takeoff and landing speeds, the amount of stick movement and resulting stabilizer - elevator movement required are considerably greater. Therefore, the greater the speed, the more control effectiveness or controllability available. In flight test, takeoffs have been made in F-86s at much higher speeds than are recommended. In every case, the takeoffs were made without difficulty.

★

Bob Hoover is a graduate of both the Air Force and Navy test pilot schools. He was a Spitfire pilot in World War II, and became a flight test pilot at Wright Field after the war. For the past 5½ years he has been assigned to numerous flight test projects at North American Aviation. He also has conducted pilot indoctrination briefings and flight demonstrations on North American aircraft.

Nosewheel Lift-off

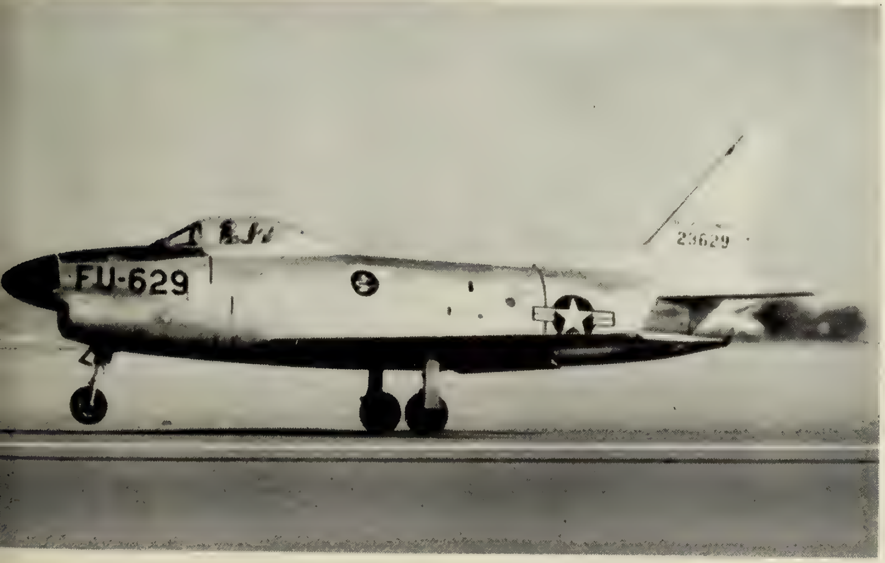
A number of takeoff accidents have occurred because the pilot was unable to obtain nosewheel lift-off at a given airspeed or at a given distance down the runway. A variety of conditions

could delay the nosewheel lift-off. For example, the external store configuration makes a great deal of difference; the heavier the gross weight, the higher the airspeed before nosewheel lift-off.

Incorrect placement of tailpipe segments on F-86A, F-86E, F-86F and F-86H aircraft also can delay nosewheel lift-off. It is the pilot's responsibility during the walk-around to check that segments are placed correctly. Segments at the 12 o'clock position would increase the speed considerably at which nosewheel lift-off takes place, regardless of the external store configuration. The correct way to add segments is given in the Flight Handbooks.

Dragging brakes have delayed nosewheel lift-off during the takeoff run on some F-86H airplanes. (I have not heard of this occurring on other F-86 series.) The dragging brakes create a nose-down moment which delays the nosewheel lift-off speed. When this occurs, the pilot has a sensation of being glued to the runway. However, it takes considerable braking to prevent nosewheel lift-off. For example, at 150 knots it takes more than 50 per cent of the maximum available braking to prevent the nosewheel from coming off. When the airplane breaks free of the runway, the sensation is similar to that of being catapulted. I do not know of any takeoff accidents resulting from dragging brakes. A recent engineering change was proposed to eliminate the dragging brake problem on takeoffs.

Pilot should check airspeed, engine RPM, tailpipe temperature in delayed nosewheel lift-off.



Nosewheel lift-off could, conceivably be delayed by a forward center of gravity. However, if the CG is kept within normal limits, nosewheel lift-off is not a problem.

In all cases of delayed nosewheel lift-off, the pilot should check the airspeed immediately, the engine RPM and the tailpipe temperature. Accidents have occurred when tailpipe temperatures or engine RPM dropped and the pilot aborted the takeoff. My own suggestion is that the throttle should not be chopped when the tachometer or tailpipe temperature indication is the sole indication of power failure.

Power Loss

With a limited amount of experience, a pilot can tell whether or not

Above, external stores calls for different takeoff technique. Below, pilot makes sure he doesn't assume too steep attitude.

In formation takeoffs, below, extreme caution should be taken when slatted and solid leading edge F-86s are both scheduled.

he has a rapid loss of thrust, although it is true that a gradual decrease of power is difficult to detect without instruments. If you have an actual sudden drop in tailpipe temperature, you can rest assured that the RPM will follow rapidly. With most of the airplanes I've flown, the noise level of the airplane, as well as the failure to accelerate at low speeds, definitely aids in the detection of a rapid loss of power.

If engine power loss occurs during takeoff on F-86A, F-86E and F-86F aircraft, the pilot must select manually the emergency fuel system before the RPM drops to 80 per cent. If the engine RPM falls below 80 per cent, the takeoff must be aborted because there would not be enough time to first retard the throttle to idle and then switch to the emergency fuel system and advance the throttle slowly to prevent compressor stall.

Aborting Takeoffs

Many pilots choose a point on the runway with the thought in mind that if the airplane is not airborne at this point, the takeoff should be aborted. This thinking has merit if you fly the same airplane day in and day out with a consistent external loading and from the same runway or field at a constant temperature. Thrust varies from one engine to another. Normally, you fly an airplane clean one day, with stores another. Temperature varies from day to day and throughout the day, also the field elevation is different at each base.

For these reasons, the Flight Handbook Appendix charts must be consulted for a reliable takeoff point. Personally, I cannot mentally calculate exactly what my takeoff run should be without consulting these charts. Yet, even though the charts are consulted, a certain margin should be allowed for differences in pilot flying technique.

Most of us have determined through experience that on a cold day a jet engine produces considerably more thrust, and on a hot day, less thrust. However, the thrust ratings on an engine are based on standard day temperature. The charts in the back of your Flight Handbook consider the temperature effect on thrust.

You should never forget the possibility of a shift in wind direction during your takeoff run. Normally, you would not expect a wind shift of sufficient magnitude to cause trouble

For a reliable takeoff point, make sure you consult the Flight Handbook appendix charts.

during takeoff. Yet, there have been cases when a direct crosswind shifted to a quartering tailwind of considerable velocity.

6-3 Solid Leading Edge

The 6-3 solid leading edge was put on some F-86 aircraft because of certain advantages it offered in air-to-air combat. (See "The Edge in Performance," FLYING SAFETY, November 1955.) However, this gain in performance was not achieved without some sacrifice. As a result, the recommended nosewheel lift-off and takeoff speeds for airplanes without slats are distinctly greater than those for airplanes with slats.

In the early days of the Korean conflict, it was recommended that nosewheel lift-off be accomplished as soon as possible to avoid shake and possible damage to the nosewheel steering mechanism from the rough runways. This recommendation was applicable to slatted-wing F-86s but could lead to disaster if applied to an airplane with the 6-3 solid leading edge. Prematurely lifting the nosewheel and holding the airplane in a very steep, nose-high attitude prolongs the ground roll considerably. The resulting ground stall is indicated by failure of the airplane to lift, and loss of acceleration.

If the pilot realizes that he has assumed a nose-high attitude and has as much as 1000 feet of runway available, he can drop the nose and gain approximately 10 knots within an additional 1000 feet of roll. At that time, the airplane should have sufficient speed to become airborne.

In an F-86F with four external stores, I found it possible during a maximum performance takeoff test to roll for as much as three miles without becoming completely airborne while holding the stick full aft and assuming a nose-high attitude (stalled). Occasionally, the airplane would lift off the ground slightly and then experience a yaw and roll before sinking back to the ground. This test was conducted from a dry-lake bed.

The pilot who assumes too steep an attitude and fails to realize it until he is beyond the point where he can drop the nose to gain more speed still has the opportunity of jettisoning all external stores. This should get the airplane airborne instantly, since the airplane can attain a speed of approximately 130 to 135 knots in this steep attitude. Of course, this speed is insufficient for takeoff under a heavy gross weight condition. Yet, for the clean airplane, this speed is quite adequate for lift-off.

Several accidents have occurred as a result of the lead airplane having slats and the wing airplane having a solid leading edge. The slatted leading edge airplane will become airborne at a lower speed and with less takeoff roll than is possible with a solid leading edge. After the lead airplane becomes airborne, instinct causes the pilot of the second airplane to pull back on the stick to break ground. This can lead to the hazards encountered when an excessive nose-high attitude is assumed in a solid leading edge airplane. Extreme caution should be exercised on takeoff when the slatted and solid leading edge airplanes are scheduled together for formation flying.

These are some of the items you should remember to avoid trouble during takeoffs. Knowing your airplane and what to do in case of emergency will eliminate many of the takeoff difficulties.

- Check for maximum stabilizer deflection.
- Check for maximum stabilizer rotation rate.
- Check for correct takeoff trim.
- Check tailpipe temperature adjusting segments for correct position.
- Consult charts for takeoff distance based on your field elevation, field temperature, wind conditions and external load configuration.
- Note proper takeoff speed for configuration, and recommended nosewheel lift-off speed. Do not pull the nose high prior to recommended takeoff speed.
- If stall is encountered, drop nose momentarily to unstall, and then complete takeoff (6-3 leading edge).
- If stores are installed and stall is encountered on takeoff run, proceed as stated above, except jettison stores if insufficient runway is available (6-3 leading edge). ●

HIGH

Major Brent F. Walker, 3d Weather Gp, Ent AFB, Colo.

Contrails are beautiful to behold: they are useful, too. They could well mark the path of an aggressor toward our defensive perimeter. Here is an article that will give you the low-down on a high-up flight phenomena.

★ ★ ★

CONDENSATION TRAILS are a familiar sight both to pilots and the public. The word contrail is now a part of the layman's language, and may invade Mr. Webster's realm at any time.

You may not have given them much thought, as you crane your neck upwards and watch airborne Rembrandts deftly inscribe their artistry across the heavens, but these wispy, flowing streamers have a peculiar importance to the defense of the United States.

Enemy Tipoff

These plumes, which appear magically behind a streaking aircraft are actually defense aids. Their existence may be the only tipoff to the presence of an enemy armada over our defensive perimeter.

Actually, there are two kinds of contrails: Aerodynamic and engine exhaust. Both are a result of supersaturation of the air with moisture in the wake of an aircraft.

Before you are carried away with the serenity of it all, you ought to know how these vapor scarves are formed; how the Air Defense Command is assisting the Air Weather Service in obtaining information on them, and how they could possibly be used as an initial clue that an aggressor had committed himself.

If you've pulled some G in a sharp pull-out or in a high speed turn, your wingtips or, in bygone years, your propeller blade tips formed aerodynamic trails. This type of trail fades very rapidly.

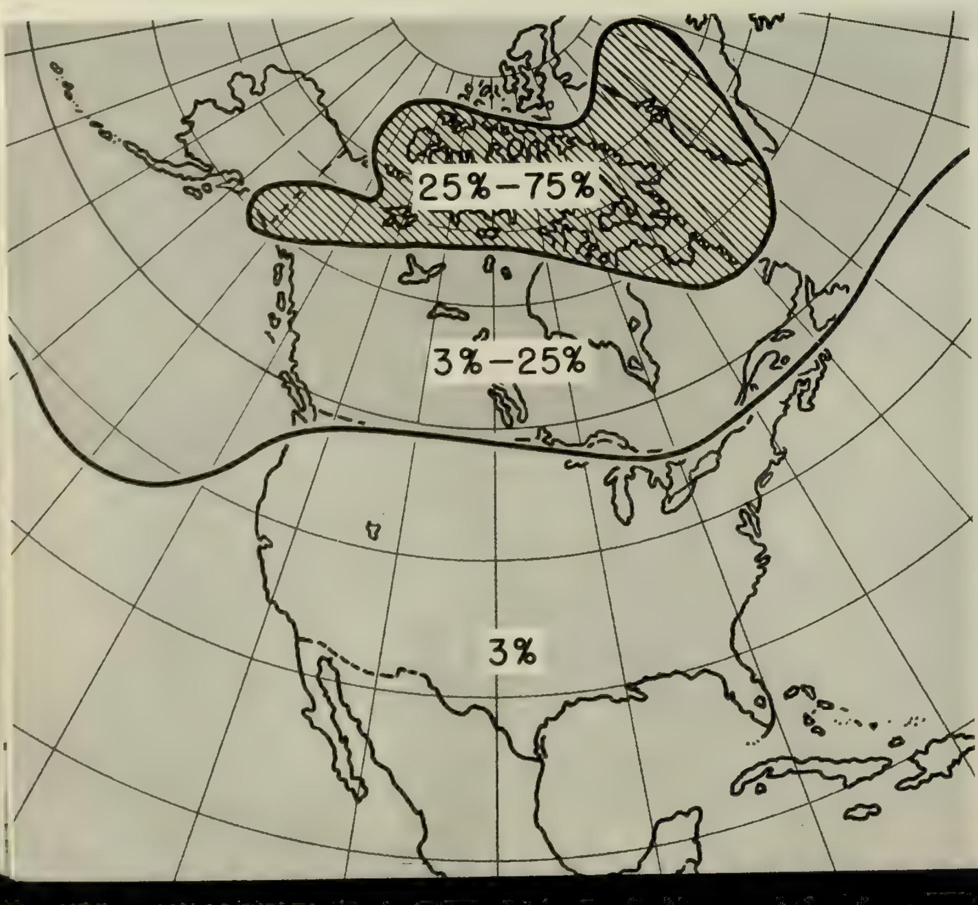
If you've tooled around the area this winter or last summer at high altitudes and have seen your path etched lingeringly across the blue sky, you have formed the other type; an engine exhaust contrail.

Forming of Contrails

The forming of contrails depends upon three basic factors: Temperature, pressure and relative humidity of the air into which exhaust gases are expelled. The lower the temperature and pressure and the higher the relative humidity, the more likely it is that contrails will form.

If the air in the wake of an aircraft becomes saturated with water vapor, and if it is cold enough, water droplets will form and will freeze as soon as they have formed. Excess water vapor will begin immediately to adhere to the ice particles without going through the liquid states. The resulting concentration of ice crystals is enough to make the trail distinctly visible for a long period of time.

Below and opposite page maps depict contrail probability in July.



SIGNS

Contrails leave your mark for all to see. Actually they are an important defensive aid.

Project Cloud Trail

Actual data on these factors have ıot been available in the past. To obain and provide this information on contrail probability, clear air turbuence and cirrus clouds, the Air Deense Command has set up Project Cloud Trail with the Air Weather Service, MATS.

Under this project, 38 fighter-intereptor squadrons collected data once laily over 24 upper air meteorologial stations in their vicinity. Taking off within an hour or two of the reease of the 1530Z RAOB (radio ıerial observation balloons), aircraft vere vectored to a point 25,000 feet ıbove the upper air station. Starting t this altitude, they climbed to maxinum altitude. En route, they oberved the heights of layers at which ondensation trails occurred and reorted if they were continuous, internittent, pronounced or faint. Also, hey observed heights of cirrus and ıaze layers and the presence of turulence of any type.

This information enabled AWS to letermine the accuracy of its method or estimating contrail occurrence.

With this knowledge then, ADC is n a position to supplement its radar yes with human eyes.

As a means of detection, contrails re important because the aggressor's meteorologists cannot forecast accurately the probability of contrail formation at the place of penetration. This, of course, is a definite advantage to a defender.

Tactical surprise can be minimized, if not nullified, by only one aircraft in an entire operation leaving a visible contrail.

Visible Evidence

On clear moonlight nights and most days from shortly before dawn until shortly after dusk, the existence of contrails will assist the use of day fighters as well as all-weather fighters in waging an attack against an aggressor aircraft.

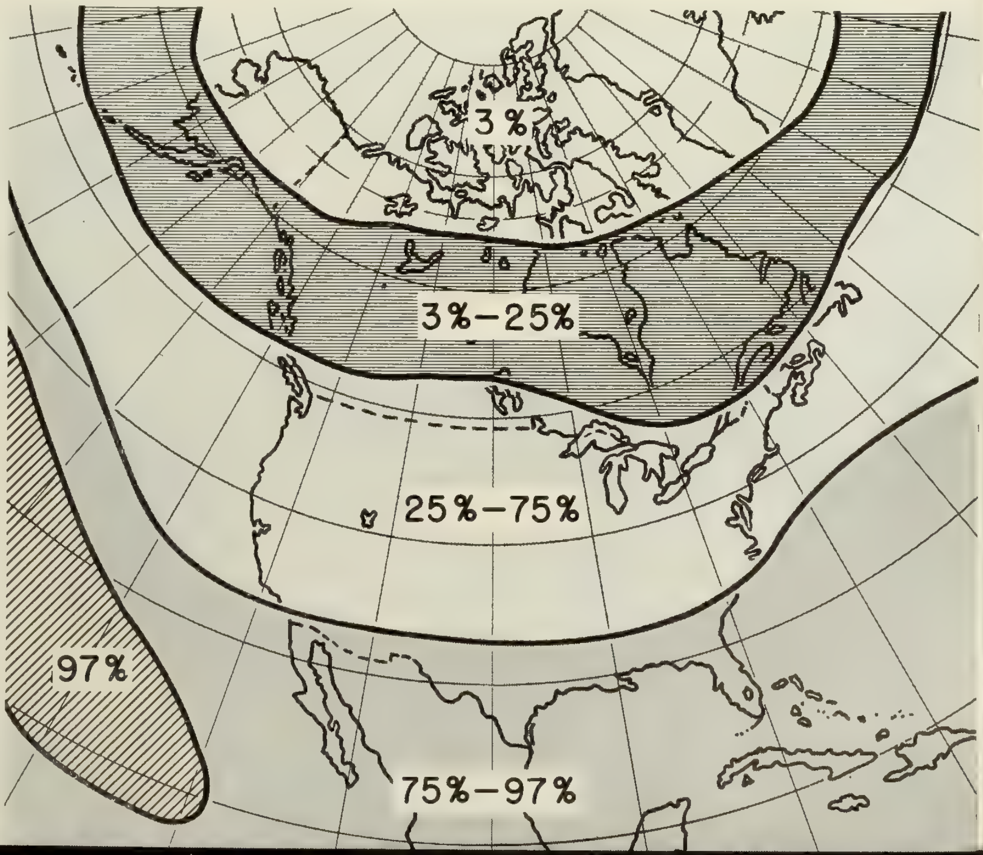
The enemy can jam radar as effectively as he desires but if he is pulling contrails, it all goes to naught, for they will leave visible evidence of his passage through the sky.

Contrails can reduce the effectiveness of infra-red radiation emanating from the tailpipe of a jet aircraft. Contrails can make it difficult for the seeking device to "see" the target from astern. This, of course, may be a disadvantage for the interceptor pilot employing a weapon with an infra-red head, should he be closing in a stern chase.

Also, contrails can seriously restrict the visual sighting of a rear firing gunner.

This all adds up to the fact that through the use of contrails, possibly the interval between the scramble and the tally-ho may be reduced. This could mean the difference between interception and destruction or evasion and bombs-away. ●

In the two maps, note the reversal with height. Trends are seasonal.



LUCKY 13

Lt. Col. Alexander Kouts, Hqs Air Weather Service

WHAT SORT OF a flight was it? It was like any other flight—not too bad, not too good. Overhead there was a blanket of cirrus that had pulled over him about five minutes back, and below him the village and city lights could be seen occasionally through the increasing murkiness of ground-hugging clouds. This was not according to the picture given him before takeoff. Things were beginning to foul up a little down there. It was nice to fly over the stuff but like all things that go up, he must come down. It was time now to worry about just that.

He must be within range of Maxwell Air Force Base. What was that UHF channel they briefed him on? Thirteen, that was it. With a twist of the UHF selector knob he called, "Maxwell forecaster, this is Air Force Jet 10912. Over."

A moment of silence and then—"Air Force Jet 10912, this is Maxwell forecaster. Go ahead."

"This is Air Force Jet 10912, at 33,000 feet, estimating Andrews at 2135. Give me the Andrews *forecast* weather."

"This is Maxwell forecaster. Roger, stand-by, out."

He relaxed once again. Hope he doesn't take too long. He couldn't stay on this channel forever. Things sure have changed for the better. A pilot could now get a running weather briefing while en route to his terminal. This is a far cry from the old days. His thoughts were interrupted by the Maxwell forecaster calling him again. He answered quickly.

"This is Maxwell forecaster. Andrews weather for 2135 Central is 300 overcast, visibility ⅛ mile with steady, light rain. No improvement expected for the next three hours. Alternates, if needed, are Donaldson, Langley or Maxwell, and all will be above 3000 feet and three miles visibility. Over."

Time for decision—lucky he called in. Weather must have rolled in at Andrews sooner than expected. After acknowledging the forecaster's call, he decided to land at Maxwell.

Yes, it was a flight like any other flight, but something had been added: Pilot-to-Forecaster Service.

The service referred to in this instance was not like that provided at some bases over the past years, where — under emergency conditions — pilots could talk directly with the forecaster through the remote VHF facilities of the control tower. This is a brand new service. It affords a separate pilot-to-forecaster UHF frequency to be used, without restriction, for all types of aircraft.

The facility which allows for this service is designed to provide one UHF channel for direct service from Air Weather Service detachments. It consists of a single-channel transmitter and receiver with remoted speaker and microphone (SFEL Package FA-1-02), located in the forecaster's working space in the weather station. The equipment is installed, maintained and flight checked by Airways and Air Communications Service.

The UHF channel is monitored continually by the forecaster for your calls. Normally, this service will be on a frequency of 344.6 mc, with a power output of approximately 100 watts. Overseas locations may be forced onto other frequencies.

There are approximately 100 pilot-to-forecaster facilities programmed for the ZI which in effect will provide excellent coverage for weather service for cross-country flying almost everywhere in the United States. There should be at least 25 completed installations by the time you read this, with the remainder to follow in short order. Facilities have been programmed also for overseas locations.

Reference to the bases that are equipped with this pilot-to-forecaster service can be made in the Radio Facility Charts. For example, Hill AFB, Utah, lists in the "Remarks" section, the letters, PFSV. Translated, this means pilot-to-forecaster service available. You will find, also, the above letters applicable to the older type, VHF, services still in operation.

Why this super service? The answer is quite obvious. It has long been recognized by many that weather service must be stepped up for jet type aircraft. Jet aircraft must have weather information before descending from altitude. Further, ARTCs are not yet fully geared to provide the prompt type of en route service required by jet aviation. This program fills this need.

To get the most help from this facility, here are a few rules:

- Since you must guard ARTC frequencies, the forecaster cannot originate service. Ask and you shall receive.
- Check Radio Facility Charts before departure for en route and operating pilot-to-forecaster facilities. NOTAMS will tell you if the facility is inoperative. A little insurance goes a long way.
- Be sure to ask for what you need. An observation is past history; a forecast covers current and impending events. This is important. Ask for a forecast.
- Volunteer a pilot weather report. One assist deserves another.
- Weather forecasters only provide weather information. They do not provide operational decisions. Be the master of your own fate.

By increasing the use of inflight weather service through direct pilot-to-forecaster contacts, it is believed that a definite contribution to greater flying safety will be made. ●

Stations with PFSV

Channel 13 **1 Dec 55**

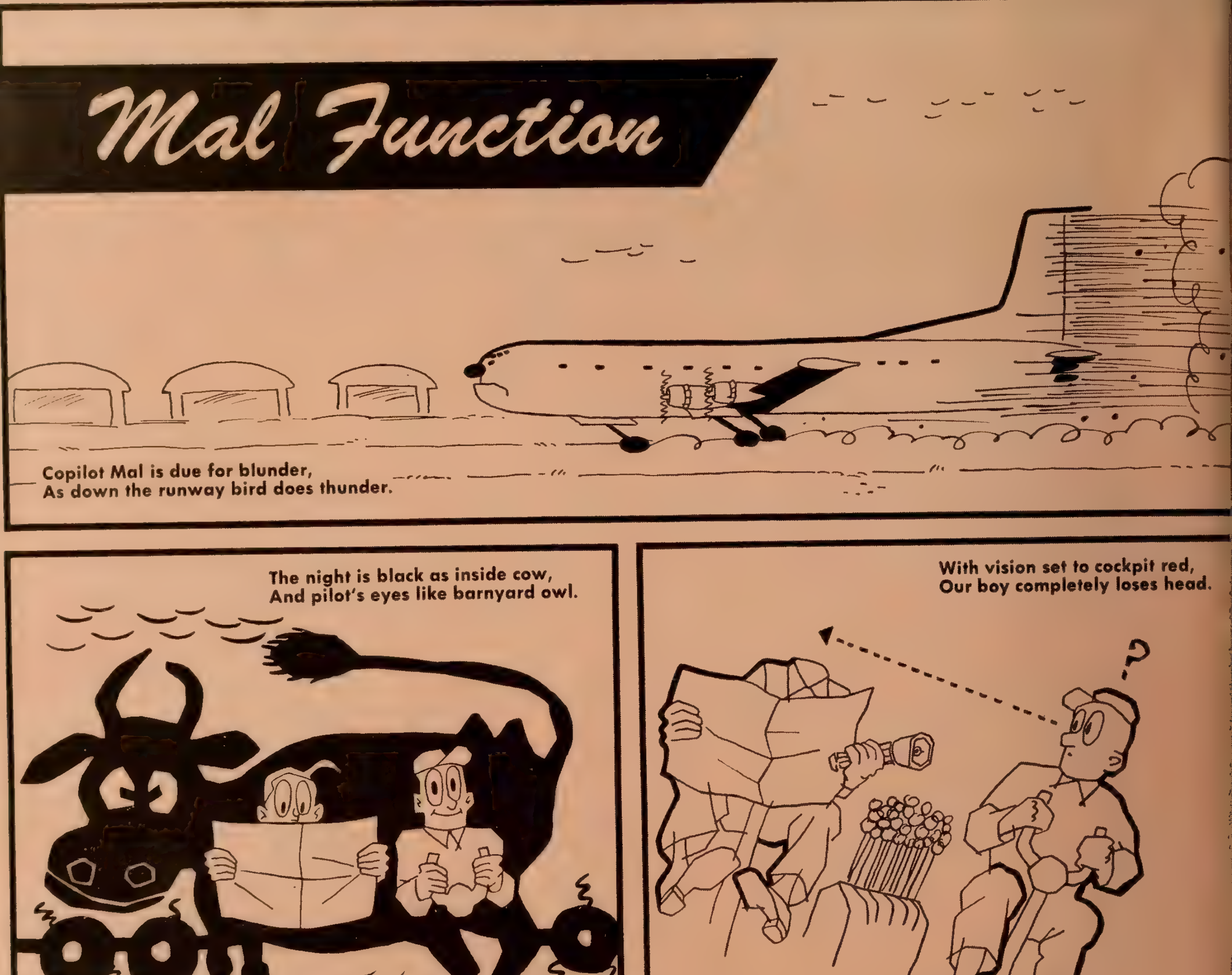
Brookley
Clovis
Forbes
Hamilton
Hill
Hunter
Loring

Carswell
Dover
Foster
McGuire
Sedalia
Fairchild
Travis

TIRED ?

Besides looking pretty, this little gal isn't doing much. But did you know that you can get tired from doing almost nothing? Your own continued well-being may depend on a better understanding of this peculiar type of fatigue. It is an occupational hazard to all pilots. The details are on page 11.

Mal Function



Copilot Mal is due for blunder,
As down the runway bird does thunder.

The night is black as inside cow,
And pilot's eyes like barnyard owl.

With vision set to cockpit red,
Our boy completely loses head.

To look at chart, employs flashlight,
And blinded pilot ends the flight.

Back into ground the airplane goes
But Mal continues . . . on his nose!

*U. S. GOVERNMENT PRINTING OFFICE . . . 362332

629.1365
FLYS

FLYING SAFETY

UNITED STATES AIR FORCE

APRIL 1956

THE LIBRARY OF THE
APR ... 1956
UNIVERSITY OF ILLINOIS

From Intakes to Afterburner

FLYING SAFETY

VOL. TWELVE NO. FOUR

● Pilot error. What is it? Is there a magic cure-all for it? Read "To Err Is Human," page 2, for your answer.

● Wind-shear is a two-edged sword. See "Change Without Notice" for the complete treatment of this phenomena.

● To get exactly what we wanted for our front and back covers, it took about four hours of towing the F-102 into position, tugging and pushing at a 20-foot crew chief's stand and waiting on the sun. After about 15 different "takes," we came up with these. All in a day's work.

A real success story appears on page 25.

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

STAFF

Editor
Major Perry J. Dahl

Managing Editor
Major Jesse F. Townshend, Jr.

Art Editor
M/Sgt. Steven A. Hotch

Production

Major Ben H. Newby
T/Sgt. Chester D. K. McCubbin
T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune
T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

Page
Flying Safety Awards 1
To Err Is Human 2
Crossfeed 5
Parade of the Centuries 6
It's in the Book! 12
Keep Current 14
Change Without Notice! 16
Well Done 21
Everyone Loves a Fat Man? 22
Low Blow 25
Taking the IF Out of Lift 26

★ ★ ★

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, June 4, 1951. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Non-Air Force organizations must query the Editor before reprinting, indicating how the material will be used. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

FLIGHT SAFETY AWARDS

In advancing the aims and objectives of a constant and integrated accident prevention program, the fourteen organizations listed below have been awarded engraved Flying Safety Plaques for the period 1 July-31 December 1955.

3599th C C Tng Sq (Ftr) Nellis AFB, Nev. (ATC)

•

Ardmore AFB, Oklahoma (TAC)

•

Hqs WADC, Wright-Patterson AFB, Ohio (ARDC)

•

64th Air Div (Def) Pepperrell AFB, N.F. (NEAC)

•

91st Strat Recon Wg (M) Lockbourne AFB, Ohio (SAC)

•

Carswell AFB, Texas (SAC)

•

56th Ftr Gp (Def) O'Hare Int'l Arpt, Chicago, Ill (ADC)

•

8th Air Div (AEW&C) McClellan AFB, California (ADC)

•

1607th Air Trans. Wg (H) Dover AFB, Del. (MATS)

•

317th TC Wg (M) Neubiberg A B, Germany (USAFE)

•

302d TC Wg (M) (2252 ARFC) Clinton Co. AFB, Ohio

•

435th TC Wg (M) (2585 ARFC) Miami Int'l Arpt, Fla.

•

133d Ftr Int Sq, Grenier AFB, N. H. (ANG)

•

155th Tac Recon Sq, Memphis Mnpl Arpt (ANG)

to err is HUMAN...

Lt. Col. Mitchell J. Mulholland, Safety Research and Analysis Division, D/FSR

TO ERR IS HUMAN—to forgive, divine. This may well be accepted as a time-worn cliche, but how does it apply in a discussion of flying safety? First of all, the pilot is human; the aircraft is neither human nor divine. Ergo, it is not inclined to forgive, although the pilot is very much inclined to err. The result? All too frequently an unplanned termination of a flight, in short, an accident.

Through the years we have been attributing half of our aircraft accidents to a thing called "pilot error." The rest are distributed among materiel failure, maintenance or supervisory error and the like. For years we have treated pilot error as a clearly identifiable cause factor comparable to the other factors which we can see and measure. In other words we have said "the pilot goofed" in exactly the same sense in which we could say "a tire blew out" or "the prop shaft sheared." Whenever an accident happened, all too often, investigators have concentrated on looking for a specific error on the part of the pilot to which the accident could be attributed, rather than considering the whole picture.

It appears time to examine this concept of pilot error more closely, to analyze what we are really talking about in the tremendous number of costly accidents we are attributing to this cause factor.

What is pilot error, anyway? One simple way of stating it would be that it is human error committed while acting as pilot of an aircraft. From this view, pilot error is no different from any other kind of error, except in the environment and circumstances of its commission. So, before we dig into pilot error, we should look rather closely at human error itself.

From the time he wakes up in the morning until he retires at night, the human animal is prone to error. Even his most unimportant activities involve decisions. Frequently, these decisions involve conflict between his education, training or experience and his animal instincts. Challenges require responses, conflicts require resolution. If the decisions are the right ones the human animal proceeds on his course to the shower, to breakfast and to his day's work.

Wrong decisions or simple deficiencies in manipulation will result in what we call errors, large or small. One blue sock and one black sock, a cut while shaving, a misreading of the clock—all these are the little errors with which everyone is all too familiar. We don't worry too much about them because they are usually inconsequential, no disastrous results follow. Get that word "inconsequential." It means essentially "no consequences." We'll come back to that.

If we watch the human closely, we have to admit that he is making errors of some kind, constantly. For that reason we try to surround him with safeguards, guide lines and reminders to prevent the more serious errors or to minimize the consequences. Our lives are regulated by more safeguards of this sort than we care to admit. In our daily life, alarm clocks, mirrors, night lights, all are at least partially little crutches to help us on our way. Traffic lights, stop signs and traffic regulations themselves are designed to protect us from our own errors. Let's face it. What is the eraser on the end of a pencil for?

In the military environment, safeguard by regulation reaches a fantastic level. Every action is so prescribed by directive that one of the most common human errors is lack of familiarity with the safeguarding directives. Watch this now because a significant aspect of our problem begins to show up through the murk. A human can be given a task to do. In performing this task, he is prone to error. So we write out guidelines and directives to keep him on the straight and narrow. Fine, so far. But as the complexity of the task increases, the volume of the directives may increase as the square of the complexity.

The end result may well be that the human's struggle to keep abreast of the directives may tax his capacity *more* than the task itself. But, in a nasty, smug kind of way we can sit back and judge him because we now have an easy way to charge him with a specific mistake. We don't have to rack our brains so hard to figure out what he did wrong. Now we can say with authority, "He failed to comply with paragraph 12d (1), AFR XX-X, dated 1 September." So there is thought number one. Are we solving a problem by multiplying "Thou Shalt Nots," or are we just clouding the issue? This is not to say that directives are not necessary. They are. But if we are to study human error, its diagnosis and cure, we're not curing a thing by just saying that a man failed to comply with a certain directive or regulation.

Let's get back to this human who has finished breakfast and has gone to work. We must admit that his errors continue. His day is crowded with little mistakes, varying in importance with the degree of his responsibilities. Mis-spellings, misplaced correspondence, dialing wrong numbers on the telephone, miscounting change at lunch, forgetting to pick up cleaning, on and on.

The functions of command and management involve manifold and gross errors of judgment and evaluation every day by people of every level of rank and experience. Many of these errors cancel each other out. But the key point to these errors is that they are committed in a human, social environment, which is a forgiving one. Humans are prone to error but they are also resilient and adaptable. They can forgive, correct or allow for the errors of others. If it were not for this cushion, our daily lives would be a series of one disaster after another.

Now, put this human to work with a machine instead of with other humans. Put him at the wheel of an automobile,

In our daily life, alarm clocks, mirrors, traffic lights and stop signs all serve as safeguards.

at the controls of a lathe or press or in the cockpit of an airplane. The soft cushion of human tolerance is gone now. The machine is governed all the way by the stern unwavering laws of physics, chemistry and mathematics. It doesn't give; it doesn't forgive. It may fail because of physical forces but it does not make mistakes. Action is followed by reaction; the laws of gravity, mass, inertia, temperature and pressure continue their implacable sway.

When a human sets these forces in motion he must obey their laws without question. That is, of course, why mistakes become costly when the unforgiving machine is involved. The magnitude of the consequences will now only depend on the potential of the machine to cause damage. A mistake with a hydraulic press has more disastrous potential than one with a Handy-Dandy can opener. And what machine can match the destructive potential of a 700 mph aircraft at low altitude, loaded with ammunition and highly volatile aviation gasoline? This is a controlled bomb, and mistakes it does not forgive. This is thought number two.

Now, an error is an error, no matter how thin you slice it. It is the consequences that give us cause for concern. Remember that word "inconsequential?" The error that results in nothing more serious than a soup spot on the vest and the error that results in a fatal crash are similarly alike in their basic nature.

The machinery of human error is the same. The error is simply an inadvertent deviation from a correct procedure or routine. The implication is obvious. Errors committed in an environment with disastrous potential such as an aircraft are errors we can ill afford, and they should be guarded against by every effective means at our disposal.

Is this being done? A few moments devoted to honest self-examination might be most beneficial to every pilot reading this article.

"Breathes there the pilot with soul
  so dead
Who never to himself has said
'Whoo! I'm glad I got away with
  that one!' "

From pre-takeoff planning to termination and "normal deplaning," a flight presents a constant series of challenges to a pilot. It is a rare flight that does not see an error of some kind committed at some time during its course. Self-examination is frequently very revealing. How many times have you *assumed* something was okay, without checking? Had trouble starting an engine because you forgot to turn on the switch, or the fuel? Failed to maintain an eagle-eye watch for other aircraft, especially at night? Taken off without checking controls for free movement? Forgotten to change fuel tanks? Sure, a checklist covers these items in most cases, but have you *always* used it? How often have you failed to contact a ground station because you were on the wrong channel? Or yelled yourself hoarse trying to talk to a CAA station

". . . the perfect pilot has all the virtues of Steve Canyon, Rex Riley and Davy Crockett."

Copyright 1956, Field Enterprises, Inc.

that was clearly shown in the Facility Chart as having "no voice?" Or, pushed on into questionable weather under VFR to the tune of the old sad song: "Oh heck, it'll burn off by ten o'clock?" We could go on and on, but you get the idea.

How many errors does the average pilot make every day that by pure luck do not result in an accident? Nobody knows, but it's likely that the answer would scare a lot of people. When we say a pilot committed an unsafe act, are we really saying anything? When we charge an accident to pilot error, aren't we really saying "This was just one of many errors, only this one paid off in an accident?" Every hour of every day the sky is occupied by many, many aircraft whose pilots are constantly making errors. This very minute as you read this, a hundred errors are probably being made aloft by Air Force pilots. An alarming thought? Yes, it certainly is. Why aren't aircraft falling out of the sky like flies? Simply because in 99 out of these 100 cases, other circumstances have not combined to allow the error to bear fruit.

No one can question the fact that our aircraft are becoming more and more demanding on the pilot's capabilities. At the same time our flying safety performance has been improving. This proves that our pilots, by and large, are trying hard to meet the stiff requirements confronting them. Our analysis of accident cause factors, however, has not progressed so as to stay in step with our equipment. We are talking and thinking of pilot error in the F-100 in the same way as we did with the P-12. Not that we were right then, but our approach suited our purposes. Now that we are standing on the threshold of pilotless flight and our present day aircraft are calling for the absolute maximum in errorless performance from our pilots, a reappraisal is warranted.

We have been assessing pilot error by comparing our pilots with something that does not exist. It is a statue, a mythical being known as "the perfect pilot." This boy has all the virtues of Steve Canyon, Rex Riley and Davy Crockett, rolled into one. He is the guy who never forgets, whose technique is flawless, who never louses up a forced landing, and who never, never forgets to close out his flight plan. He is every "Well Done" personified in one handsome, broad-shouldered frame. He is a wonderful person and if he were real he should roast in hell.

By comparing our pilots with this paragon, we can easily slide into the concept that a successfully completed flight means the pilot was perfect. Especially if the pilot happens to be *me*. The corollary is that a pilot whose error precipitates an accident is therefore an inferior being. He has somehow failed to meet the standard. Standard? "Wonder boy" is the standard, therefore no pilot in the whole Air Force meets the standard.

When an airplane piles up at the end of a complicated chain of events, do we approach it with the attitude that "the pilot must have goofed somewhere," then find an error and blame the whole can of worms on that error? What guarantee do we have that the next pilot coming along, faced with the same circumstances, won't make the same error? That's our job—to head off the second error.

We know that no pilot is perfect. The only difference is that the "level of constant error" is higher in some pilots than in others, and those with high levels are therefore more vulnerable to accidents when the variables combine to clobber them. Training and supervision are tools that can help lower this level. It's a little like having enough antibodies in the blood to repel invasion by germs. We want to repel invasion by circumstances, weather, materiel malfunctions and all the other variables that can put a pilot on the spot. A low error level can help prevent these other factors from causing disaster.

So, if the pilot goofed, let's find out first if this was a goof that other people are likely to fall into. If so, let's do something about the cause. If it was an isolated case, peculiar to this one human, let's see why it had to pay off in an accident. Maybe this too could have been averted, could have resulted in nothing worse than a close call, one that would have scared the pilot enough to teach him a lesson, but not kill him. Was his accident indicative of a high error-level? If so, why was it high? And is there anything we can do about it?

What can we do? We have two tasks to accomplish. One is a goal, the other is a means to the goal. The goal is to reduce the frequency of pilot error accidents; in other words, to reduce the number of errors committed in flight. The other task is to make a more realistic evaluation of the errors committed so that we can get at the cause.

People don't make mistakes purposely. They are traceable to one or more of several areas. One, of course, is that of human inadequacy itself, which includes inability to maintain concentration, lapse of memory, fatigue and so on. Another area is built into the machine itself. Design frequently neglects human factors. Errors are made more likely and their consequences more serious by built-in "booby-traps" in the aircraft and its operating procedures. The third area includes the entire environment in which the pilot operates—his schedule, his training, his supervision, the weather and operating conditions; in short, any and all of his surrounding daily circumstances.

These influencing factors will be discussed in detail in subsequent articles. The main point to be understood right now is that these factors exist, and that pilot error cannot be considered by itself, in a vacuum, as it were.

Accidents, incidents, near accidents and operational hazards give us clues to the reasons behind errors. If, in investigating them, we button everything up by blaming them on the errors alone, we have not done even half the job. This is not accident prevention, because we have taken no action to prevent someone else from making the same errors in the future. Unless we understand the nature of the error and its causes, all we are doing is fixing blame, not applying a cure.

A determined attack on the causes of error will eventually result in attainment of the major objective, which is not elimination of error, but a lowering of the overall error-level of our pilots. If we can assure that the number of mistakes per flight are reduced, the accident exposure is going to be reduced, regardless of other circumstances. This is no magic cure-all. On the contrary, it involves a common-sense application of the age-old principles of caution, planning, alertness and technical proficiency, and a conscious desire on the part of the pilot to do the job *right*. Doing the job right means doing it with a minimum of errors. We ourselves destroy more of our aircraft than an enemy could ever hope to destroy. We are, in effect, our own worst enemy. Reduce all the errors committed and the disastrous ones will decline, too. The result can be the biggest payoff in effective accomplishment of the Air Force mission that has yet been seen. ●

LETTERS TO THE EDITOR

Airways Flying

The staff of Flying Safety has in the past compiled information on airway flying in a pamphlet entitled "Flying Safety on the Airways." The publication was of great value in that it assembled all information from various regulations and flying publications pertinent to flight planning and airways flying. The publication at present is outdated.

How about a new one?

Capt. Billie J. Wetzel
FSO Kelly AFB, Texas

The one and only subject pamphlet was actually a reprint of an article from Flying Safety Magazine. It has been re-worked and will be republished as soon as it is coordinated with all interested agencies.

★ ★ ★

In the Dark

In your December 1955 issue you had an article entitled "Send A Letter," which to me sounded like an excellent idea. Since reading this article I have tried to use this letter system but to my surprise I have yet to find a base operations that knows what I am talking about. On three or four occasions, I have put an appropriate letter in the remarks section and circled it, only to get the following question thrown back at me: "What does this mean?" Can not something be done about this to circulate the letter system so that all base ops know about it? How about printing the letters in the remarks section on the 175s when they are first printed?

1st Lt Wilmarth B. Walker, Jr.
4756th Air Def Sq (Wpns)
Moody Air Force Base, Ga.

Try this treatment: Open up the Radio Facility Chart to Special Notices section, and make believers out of them. It's in the book. Many base operations stamp the letters in the "Remarks" section for the convenience of pilots.

★ ★ ★

B-26 Exits

As Air Force Adviser to the 106th Bombardment Wing (T), New York National Guard, which is equipped with B-26 type aircraft, an item of flying safety concerning this aircraft has been brought to my attention. Considering its importance to all personnel flying B-26s, I am forwarding this information to your publication.

In accordance with the current T. O. 1B-26F-1, revised 22 July 1953, emergency exits from the rear compartment of B-26 aircraft are designated in the following sequence:

a. Primary — through bomb bay doors.
b. Secondary—through side door.
c. Tertiary—through top hatch.

In order to effect an exit through the bomb bay, it is first necessary to open the bomb bay doors which are directly dependent on the proper operation of two systems, electrical and hydraulic. A malfunction of either system would prevent the use of the bomb bay as an exit. These would be doubly vulnerable in combat.

I believe the directive which required the installation of the side door was aimed at providing a positive and safe exit irrespective of bomb bay door operation. This feature relieves the gunner of any dependence on electrical or hydraulic systems. It is believed that this side door exit was meant to be designated as the primary exit from the rear compartment of the B-26.

In addition, NACA tests on exiting from this section of B-26 aircraft revealed that the side hatch was just as safe as the bomb bay. At no time did a body strike the tail section of the plane.

Col. Edison C. Weatherly
Air Force Adviser
106th Bomb. Wg (T) NYANG

Thanks for the latest information on the B-26. Here's hoping nobody has to use it, but if a hasty exit is required, it's nice to know what door to use and why.

★ ★ ★

Marker Authority

I have just finished reading the article titled "Runway Warpaint" in the December 1955 issue of Flying Safety. With reference to the runway distance markers, I should like to have the authority and criteria for establishing these markers on the runway. This information is requested because I have run into some difficulty in obtaining authority for such markings, and I feel that they are needed and will be of great benefit to the pilots on this base and to all transient crews.

Maj. Cody U. Watson
Base Ops Officer
Donaldson AFB, S.C.

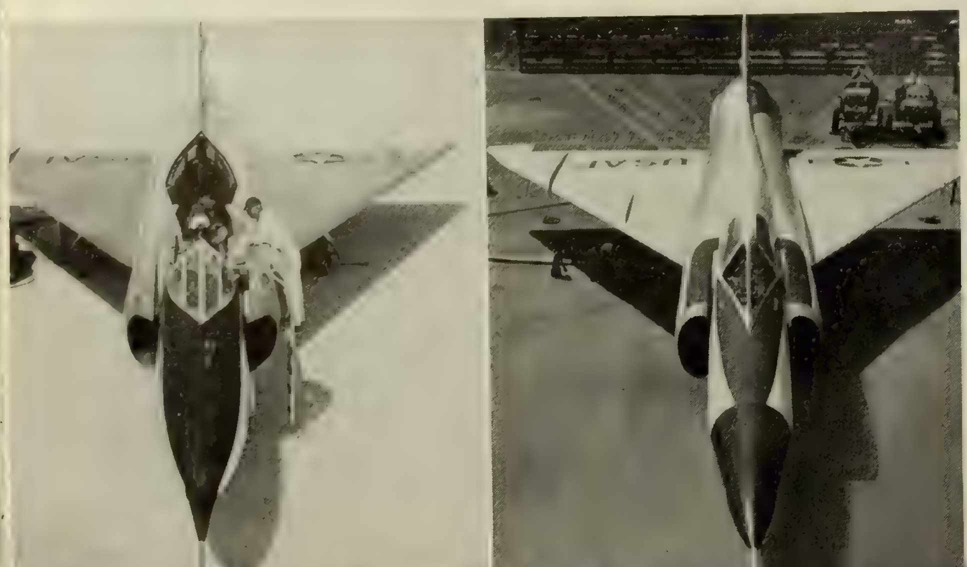
The following three sources will help you to make your marks: AFR 91-17, ATM 6003 and ATL 5035.

Parade of the

In this issue of FLYING SAFETY, the F-102 is featured. Radical in design, it is the second Century series airplane to become operational. Here is an article that you will find mighty interesting.

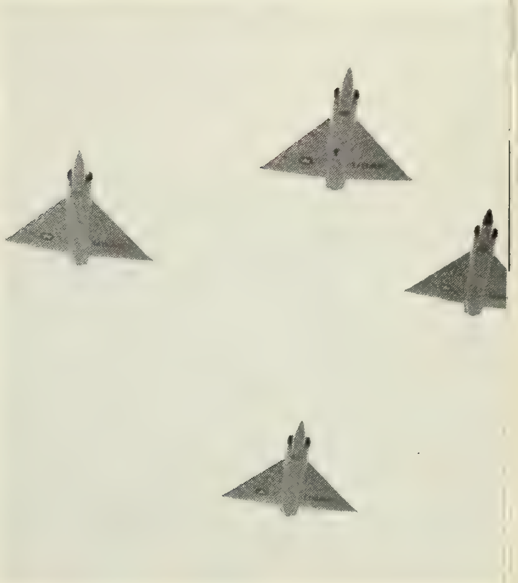
Richard L. "Dick" Johnson
Chief Engineering Test Pilot, CONVAIR

Before and after. Left, note straight fuselage on YF-102. Right is F-102A with nipped-in waist.



DURING ITS RELATIVELY short life the F-102 has had, like any new airplane, many names. Some were honest efforts at picking a good name and some just plain good humor. I'll mention one and I'm sure it will insult no one. You know what you say when the bump in the road jars every joint of your pride and joy, or when you first and suddenly see an airplane that's twice as everything as you expected. Or, perhaps when you're going umpteen hundred knots and you hit the roughest air you've ever encountered, the same thing was said by all but the chaplains when they had their first look at the F-102—so we sometimes call it the "Saviour." We also could take a line from the roadside ads that say. "One hundred and one were tried."

If you're still with me, I would like to explain that there are a few flight test items that are as yet undone. The spin program isn't complete, and the structural integrity investigation has reached approximately 80 per cent completion. Some of the investigations mentioned, and maybe all, will be finished when you get your F-102s. As of now, don't spin, don't



Centuries

exceed 5.6G and don't fly with external tanks until the Dash One gives you the okay.

Now let's have a look and then go fly. The F-102 is unusual; it has more sweep back than anything except a California teenager's sideburns. It has no horizontal tail and its wings have a low aspect ratio (short, stubby wings). Its nose-radome is more pointed than any other Century series aircraft; the engine air intake ducts are dual and have their open end adjacent to the cockpit. As a matter of fact the entry and egress ladder is hung on the left duct. The pictures used to illustrate this article adequately explain the rest of the exterior description.

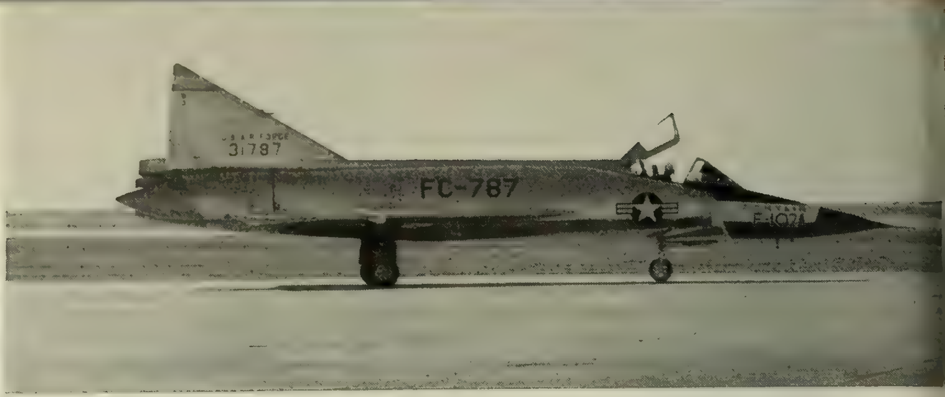
One Safety Pin

In the cockpit, following a proper walk-around check which includes all of the usual but nothing unusual, one finds a neat comfortable ejection seat with one safety pin in the right armrest. (The pin has the usual banner attached but has a convenient stow-clip on the right wall of the cockpit. The end of the banner is attached to the cockpit wall so that it can't be "stolen" or forgotten in place.)

The stick is double-headed; the right handle is for flight control and the left is the radar-fire control system. The handles are about six inches apart. The left one can be locked

From takeoff to altitude, these four F-102s show their distinctive delta-wing design, which spans 38 feet. Powered by a J-57 engine, the F-102 is 68 feet long. It is an all-weather interceptor.

Author Dick Johnson prepares for a flight.



Taxiing out, this side view shows sharp nose-radome of F-102. IDLE power is sufficient.

Below, is the TF-102A. This trainer version seats pilots side-by-side. Note wider cockpit.

Left, the TF-102A combat proficiency trainer can be used as an all-weather interceptor.

In the TF-102A, all phases of flight are closely supervised by instructor pilot.

for left-handed flying whenever the radar control is not in use. There is a curtain that extends from the top of the scope to the apex of the windshield. It completely prevents undesired reflections in the flat sharp "V" windshield. The canopy is closed easily by hand and manually locked with a push-pull control on the lower right side of the instrument panel. The seat-height control is a toggle switch on the forward part of the right armrest. Every detail of a cockpit check makes a lot of writin' 'n readin', so let's hit the high spots from left to right and then start the P&W J-57-P-23 type engine.

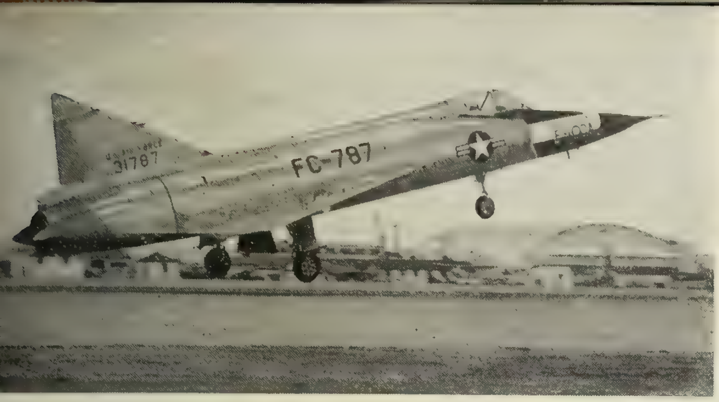
Number one type items on left console are the following controls: "G" suit, pressure suit helmet face-piece-de-fog, ARC-34, fuel shut-off and on boost pumps, R.A.T. (Ram Air Turbine power for emergency hydraulic control) throttle which includes air and ground start (identical), afterburner control and stop-cock, and oxygen regulator. Now to left sub instrument panel: cabin pressure, landing gear and emergency landing gear control. The instrument panel contains all of the essential instruments which include landing gear position, fire and overheat warning, hydraulic systems condition light, canopy unlocked light and in the amber category, the master warning light.

Armament Controls

The bottom part of the panel contains the armament controls and the center lower panel contains the stability augmentation controls, engine anti-ice control and cockpit and instrument light switches plus a crank to move the rudder pedals fore and aft. The right sub panel contains the master warning panel and test and reset switch. The right console contains electrical controls, navigation radio and identification equipment.

To start the engine with the fuel system properly set up, we push outboard on the throttle in the OFF position and hold there to at least 12 per cent N_2 RPM, then push and hold the ignition button located on top of the throttle and move the throttle to the IDLE position while continuing to hold the ignition button down until 40 per cent RPM is indicated. The engine takes over now. If the start was normal, the tailpipe temperature went to about 230°C.

Taxiing is like almost any other jet bird with nosewheel steering. If there is nothing expensive behind you, rev up the "motah" a bit and move out. If you don't own or can't pay



From outside, high angle of attack attitude is shocking. To pilot, no sweat.

Control on climbout is excellent, but requires a light hand.

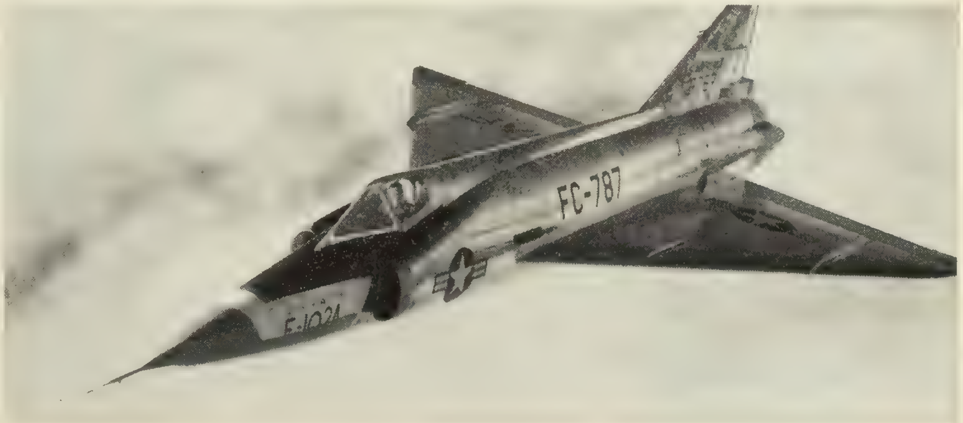
for what's behind you, move out with patience and IDLE power. The nosewheel steering button is right beside the trim switch on the control stick. All of the taxiing required can be done at IDLE power except against more wind than any chamber of commerce would allow.

Just prior to reaching takeoff position, have a look at the fold-away checklist above the forward portion of the right console. If you have completed what is indicated there under "takeoff" and everything checks out according to the book, line up, release the brakes and go.

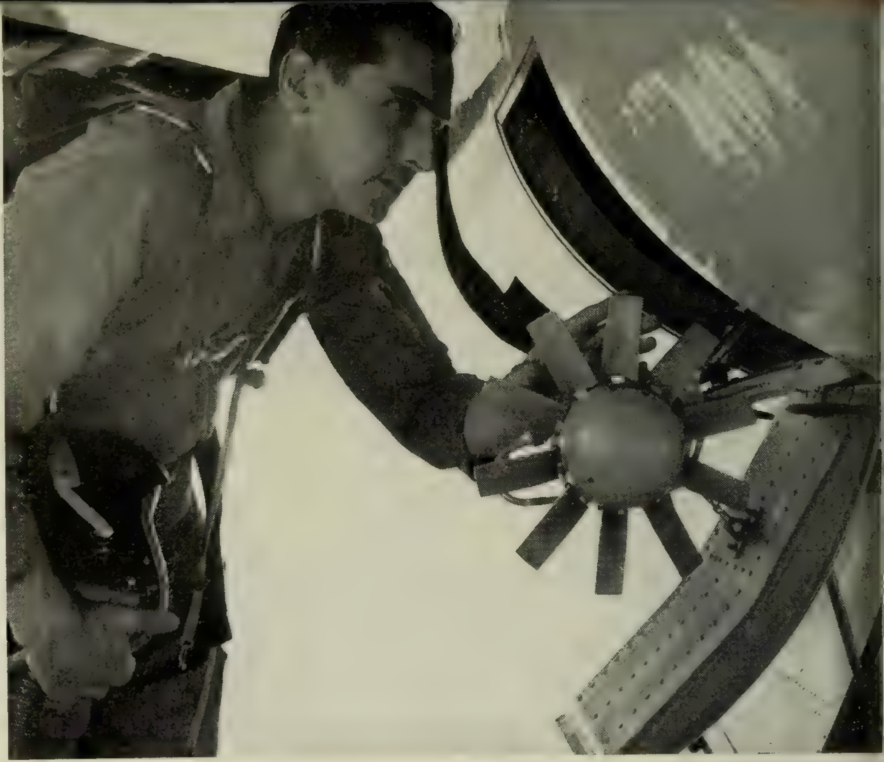
From outside, the steep or high angle of attack attitude during takeoff and landing is pretty shocking at first, but not even noticeable when you're flying the F-102. You can see straight over the nose up to 15 degrees angle of attack.

One of—if not the last checks made prior to takeoff is to see what the ratiometer says. (It's a new instrument that is a "go" or "no-go" indicator for dual compressor mills—that's California for engine.) The proper ratiometer reading will vary with temperature. You will have a simple chart to tell you what it should be for any temperature you will encounter. The chart indicates an allowable band and if we have a number

Most outstanding flight characteristic is probably good maneuverability at high altitude.



Below. Touch down at 130 knots and deploy drag chute. Brakes good, pedal force medium.



A handy gadget. The ram air turbine (R.A.T.) provides power for emergency hydraulic control.

in the band, we go. Something like 15 seconds from brake release we are airborne and the gear is on the way up. The climbout is steep, which is necessary to keep from exceeding gear limits. About half the time it takes you to get any other scope toter to 40,000, you're there. During the climb if you hurry, you have time to check to see that your dampers and turn coordinator are on. You are climbing almost straight up. Visibility is good but restricted forward because of the extremely steep attitude. Control is excellent but requires a light hand, particularly in lateral maneuvers.

If you fly an early F-102 you may have a roll restriction that puts the kibosh on high grade airshow antics but only affects the mission slightly. It will have a "black box" that makes high rate rolls for emergency situations okay but holds one to something like 120°/sec. roll rate for 180's and over while positive quadrant bank angle changes will be unrestricted. With later airplanes if you want to roll or need to, have at it. You'll find the results exactly as you planned them to be.

Good Maneuverability

The most outstanding flight characteristic is probably the good maneuverability at high altitude. With it you stand a good chance to out-maneuver any competition. Within its limitations which allow speeds over 1000 mph and as low as 110 mph you'll find a straight forward, pleasant and easy-to-handle machine. Anything that applies to any "conventional" jet airplane applies to this one with regard to ordinary good accepted flight techniques.

Before landing fire up the afterburner a time or two, including once at say 10,000 feet while indicating 400 knots or better. The result is like lighting a string of firecrackers to a scared rabbit.

The pre-landing checklist doesn't have much to say. It is basically all boost pumps on (they should stay on all of the time—check anyway) and gear down.

If I had the words of wisdom that Tony LeVier or Rusty Roth have to offer on the subject of landing jet aircraft, I could now copy them and substitute F-102 as the need indicated, and have said exactly how to land an F-102. As in all other aircraft, you will find each landing different. While striving for the perfect pattern and landing each time that we "come in," we have discovered that it is (by accepted WW II fighter standards) a very conservative landing pattern.

Partial Power Compromise

It has a downwind leg and is, as LeVier and Roth have said, a partial power compromise between a power-off landing and a high power drag in. In the F-102, you can fly the pattern something like this: Gear down at something between 200-240 knots following the break, bleed off to about 180 knots IAS for the base and then to about 160-170 knots for final with RPM near 80 per cent.

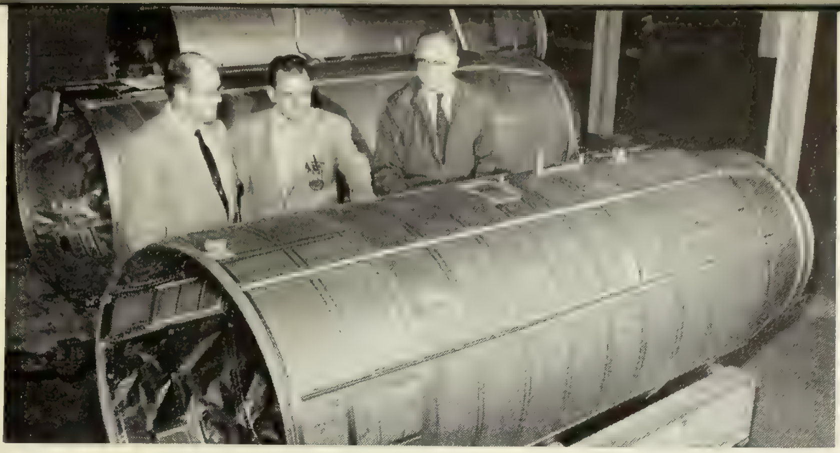
★

The author flew 180 missions in WW II in P-47s, with the 12th Air Force. He is, in his own words, credited with "one ME-109, jillions of locomotives, trucks and holes in the ground." His decorations include one Silver Star, four DFCs and 13 Air Medals. He received the Henry DeLaveau Medal for the world's speed record in an F-86A on 18 September 1948 — 670.981 mph. It was good for 4 years.

As an Air Force test pilot, he helped to deliver the first set of 50 "hard, leading edge" F-86s to Korea, checked the pilots out, and flew a few missions there. He left the Air Force as a Lt. Colonel in September 1953, and went to work for CONVAIR.

He has flown all of the U. S. fighters except the F-101 and F-104; has also flown the X-1 and X-4. Foreign types include all British fighters except the Folland Gnat and the P-1; all current French fighters, including Mystere I, II, III and IV, and two Russian fighters.

Dick Johnson has not confined his flying to the fighter types. He has flown many more cargo and bomber planes than can rightfully be called a fighter pilot's "share."

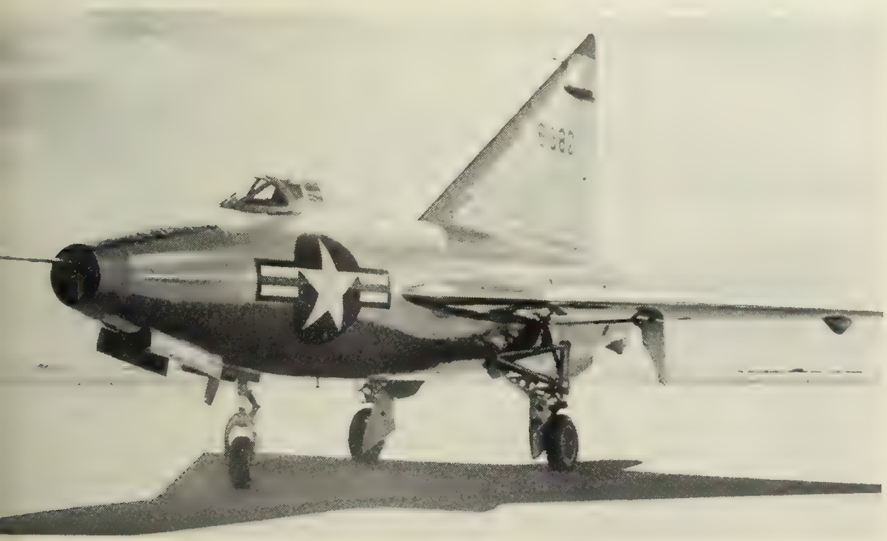


Dimpling of the entire surface of a new type of titanium shroud insulates engine from fuselage.

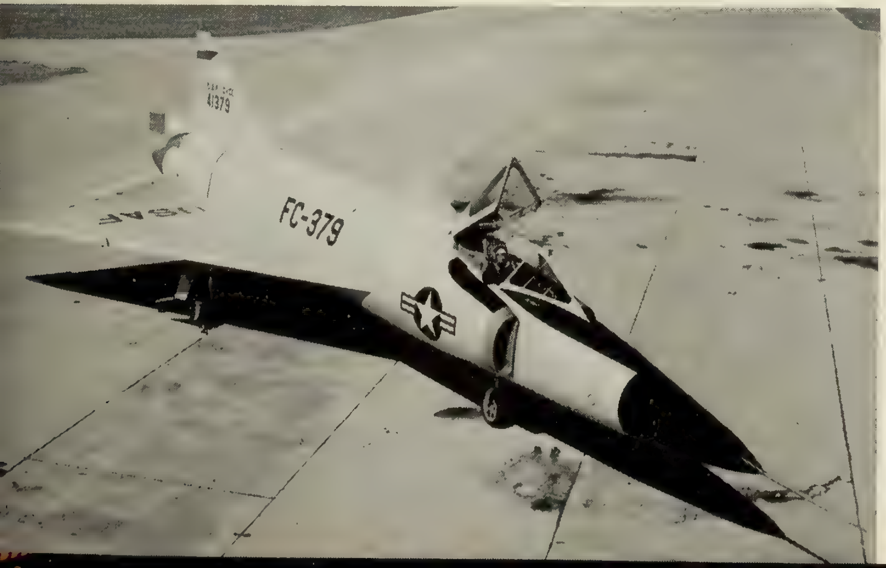
Over the fence with slightly less power and partial flare at 150 knots. Touch down at 130 knots and hold what you have (nose approximately on horizon) and deploy drag chute by pulling the drag chute handle out. Then ease forward slightly on the stick to start a gradual descent of the nose. Brakes are good, pedal force is medium. Use as required. To jettison the drag chute, push the handle back in. You may use speed brakes for landing as required. Deployment of drag chute opens speed brakes and it probably will be SOP to utilize speed brakes on all landings.

Landings are pretty important so I'll say some more on the subject. If your engine has had it, but is still turning (windmilling) freely at 200-220 knots IAS you will find the RPM at approximately 25 per cent. This is plenty for good control but extend the ram air turbine for emergency system power at the high key which can be 9000 feet, plus or minus 1000. Your low key should be about 4000 feet and base about 2000 feet. You'll find control is excellent and when and if it's positive there's more altitude than you can use, side slip as required, but with due consideration for wing loading. (Wing loading is light for a fighter.) Touch down at 130 knots IAS as for a normal landing. If your engine is dead so that there is no possibility of going around, deploy the drag chute up to 180 knots IAS and 20 feet above the deck. That's nice to know but it's the only time to do it.

Below. Can you identify this airplane? It's the XF-92A. Compare it with F-102A in lower photo.



Below is the production model F-102A. Painted all-gray, it is now going to active units.



Crosswinds No Sweat

Crosswinds are only slight nuisances up to so much as 30 knots at 90 degrees. Keep the nose high, following landings on slippery surfaces. Let it fall when it gets heavy to take best advantage of the high angle of attack for braking. The tailpipe can be dragged on landing but it takes muscle in the head, as well as in the arm to do it.

An airstart can be accomplished under extremely different conditions of airspeed and altitude. However, about 220 knots IAS and the accompanying 25 per cent is recommended. If you know your normal fuel control is okay, handle the throttle as during a ground start. If the normal system is inoperative, switch the emergency system ON by pushing the red guarded toggle switch forward. Then go through a ground start but "play" the throttle to get the fuel flow and starting temperature desired.

I haven't gone into a long dissertation as to how the F-102 should or should not be flown in all types of configurations. You'll learn these rudimentary items when your F-102s are delivered.

In conclusion, I'll say this: The F-102 is a "Going Jesse." It's loaded with sting power; it's stable and it's supersonic. I'm convinced you'll agree with me, it's a "real gone" machine. ●

It's in the

Capt. Westley H. Hamilton
Bomber Branch, D/FSR

AT FIRST GLANCE, the B-47 accident rates look very encouraging. Based on the number of major aircraft accidents per 100,000 flying hours, the rate in 1955 decreased to a low of 3.2 per cent of the 1951-52 figure. A comparison of accident cause factors shows that the number of accidents caused by materiel failure has decreased from 29 per cent of the total in 1951-52 to 13 per cent in 1954. The same comparison of maintenance error accidents indicates a downward trend from 12 per cent to 10 per cent; not so startling, but still on the credit side of the ledger.

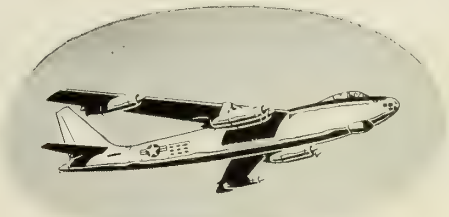
But what of the pilot error type of things? Now that's a horse in a different garage. From a not-very low of 33 per cent of major accidents during 1951-52, pilot error as a cause factor rocketed to 57 per cent of all major accidents in 1954. Think about it. Nearly 60 per cent of the B-47 major accidents during 1954 were due to a pilot's miscalculation, poor judgment or improper technique. No matter how you look at it, the pilot just plain goofed. The resultant loss of life, the destruction of and damage to aircraft, and the impact upon Air Force capability are staggering.

When we break the figures down a little more we can find the area of operation where the trouble occurs. Seventy-six per cent of the total pilot error accidents occurred during the approach and landing phase of flight. So? So why did they? Because pilots didn't maintain proper airspeed on the final approach; didn't use proper flight control technique; didn't know actual stopping distance; didn't know minimum stopping distance procedures. Does the "Bible" tell them what, when and how? Sure it does!

Reference: Tech Order 1B-47E-1

Check your handbook for takeoff calculations. Then apply them to the existing conditions.

Book!



Is reading your Pilot's Handbook enough? This article has a couple of other ideas on how to use it properly.

(the "Bible"), dated 30 June 1955, revised 30 September 1955.

- Approach and landing, pages 161-169, inclusive.
- Go-around, pages 169-170.
- Landing emergencies, pages 197-202A, inclusive.
- Refused takeoff, page 196B.
- Approach and landing, pages 545-554, inclusive.

There's nearly enough information on those pages to teach your wife how to land the airplane.

Yes, it's in the good book, and the chances are you've read it. But reading it isn't enough. You must analyze it and apply it to the existing conditions. When landing at a strange field, or at a familiar one under wet or icy conditions, or under nearly any other-than-normal situation, pause and consider a few things. Check your stopping distances for your gross weight —you might find the last part of your skid is on green grass. The stopping distance charts are good, when used properly. But just for kicks take a look at the "Conditions" down in the lower right corner (good book, pages 552-553). You don't normally chop the outboard four at touchdown, nor do you have the brake chute fully opened at touchdown, so figure on rolling a little farther. And although there's no wet concrete reference line on the normal stopping distance chart, check the other charts and you'll find you're good for another 1000-2500 feet of landing roll on wet concrete. Of course, if you're landing on wet macadam, or well oiled and rubbered concrete, better add another few feet for the wife and kids. Should your landing be on packed snow or ice, you're not braking—you're skiing!

A few other items worthy of your attention prior to landing are wind conditions, terrain features beneath the traffic pattern, runway approaches and overruns and lighting systems. Crosswinds, gustiness and vertical drafts caused by terrain features have all caught B-47 pilots unaware and resulted in accidents. There's really no need for hitting a power line or trees on the final approach, but it has been done and can be again by pilots who don't know the things exist. Crosswinds require corrective technique and gustiness necessitates an allowance when computing final approach speeds, yet neither are extreme hazards when pilots are aware of such conditions. And if you're familiar with obstructions, approach and runway lighting systems peculiar (and some really are!) to the field, then confusion is less likely. Give yourself a break by checking those items early rather than having them surprise you as you encounter them in the pattern.

After you've completed the recommended reconnaissance, it boils down to this:

- Adhere to checklist procedures and compute the appropriate best flare speed accurately.
- Allow for gustiness and turbulence; ask the tower for existing winds if not given to you.
- Fly the airplane smoothly and monitor closely the airspeed and power settings. Have your copilot help you check speed and power.
- Maintain best flare speed until crossing the approach end of the runway; make your flare slow and smooth as possible.
- On the ground, deploy the brake chute; if it malfunctions, immediately initiate go-around or brakes — only stopping procedures.
- Use wheel brakes judiciously. Learn the feel and sound of anti-skid cycling. It's important.

Simple, isn't it? You may be thinking, "Why print this simple story? Everyone knows that." The troops that broke the airplanes didn't know it or use it. But I do. How do I know? The "Bible" tells me so! ●

Stopping distance charts are good when used correctly. Don't forget runway gradient!

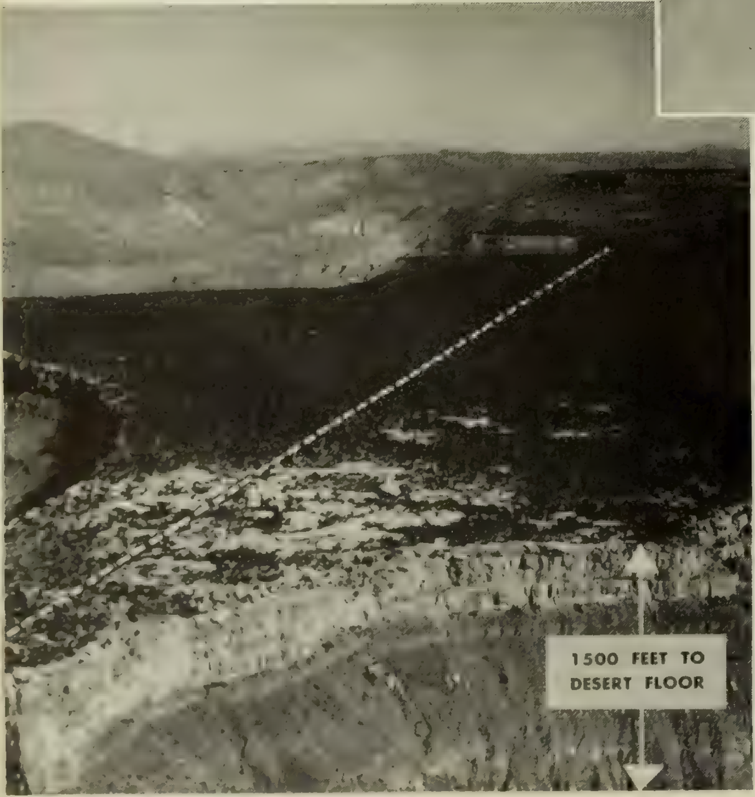
Gusty wind conditions require corrective techniques in computing final approach speeds.

Keep Current

NEWS AND VIEWS

Note nacelles, above and right, on Convair YC-131C turboprop transport. It uses T-56 Allison engines.

Below, path "SMART" takes on Hurricane Mesa, Utah. (See next page.) It was built to test ejection seats.



Flying Submarine—Still only in the thinking stage of development, the flying submarine does not differ markedly in appearance from a standard swept-wing jet fighter. However, it utilizes two power plants. A jet engine with air intakes on the upper part of the fuselage for air operation and a marine engine driving a small propeller at the rear of the craft for underwater propulsion. In flight, the marine propeller is designed to be retracted within the fuselage.

A hydro-lift landing gear or water skis can be retracted in flight. This type of gear already has been tested on several types of conventional aircraft.

In the two media operation, the pilot of the flying submarine would start the marine engine just before landing. The craft would aqua-plane until it slowed down and came to rest on its hull. Then the jet engine would be stopped, the air intakes and exhaust sealed and the cabin pressurization turned on. The craft would then take in water in ballast tanks and submerge, driven by its marine propeller and maneuvered by its airplane control surfaces.

There are many technical problems that must be overcome, but the only difference between flying in air and "flying in water" is just a question of density. ●

★ ★ ★

S-M-A-R-T—Successful, rocket test-sled runs on the new USAF supersonic test sled track at Hurricane Mesa, near Zion National Park, Utah, have shown that accurate observations can be made on the problem of bailout at supersonic speeds on both personnel and equipment.

Called SMART (Supersonic Military Air Research Track), this rocket-propelled test-track facility duplicates, on the ground, actual supersonic flight conditions under controlled instances the testing of aircraft seat ejection equipment, various types of parachutes and the effects on pilots of bailout at high speeds.

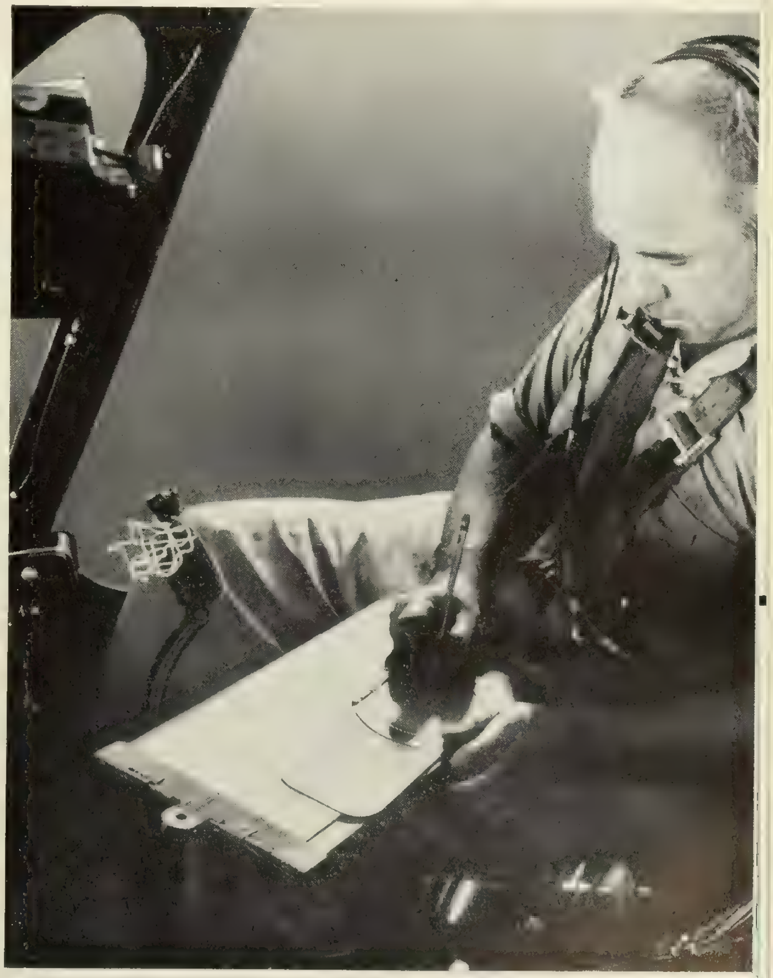
Unlike other existing test-track facilities, the SMART project was designed to provide free flight for test equipment and its recovery for further use. This is accomplished by catapulting the test equipment over a 1500-foot cliff and lowering it by parachute to the desert floor where it is recoverable. ●

★ ★ ★

Hands Off—Rotary-wing aircraft enter a new stage of stability through use of a newly developed flight control system by Sperry Gyroscope Company. The system gives the pilot full freedom for manual maneuvering, yet provides automatic stability at all speeds including cruise, hovering and engine-out auto-rotation. In manual-automatic operation, the gyros stabilize the aircraft on its existing flight path. While the pilot relaxes "hands-off," special controls hold the desired altitude, speed or climb positions. To change flight path, the pilot applies pressure to the control just as if in manual flight. ●

Unveiled recently is the Snark, intercontinental guided missile.

Above, new helicopter control system permits "hands off" flight. Below, pilot is freed for navigation duties. Light pattern on cyclic stick reveals movements required in 15 seconds of operation.



...Change Without Notice !

Maj. Lewis J. Neyland, Operations Analysis Division, Headquarters Air Weather Service

Here is an article prepared by an experienced pilot who has also served as a weather officer since 1943. Everybody is cognizant of the landing undershoot bug. Here may be the answer to at least some of these accidents. FLYING SAFETY *feels that it is important to read this article carefully and when the wind doth blow, watch out for wind shear.*

• • •

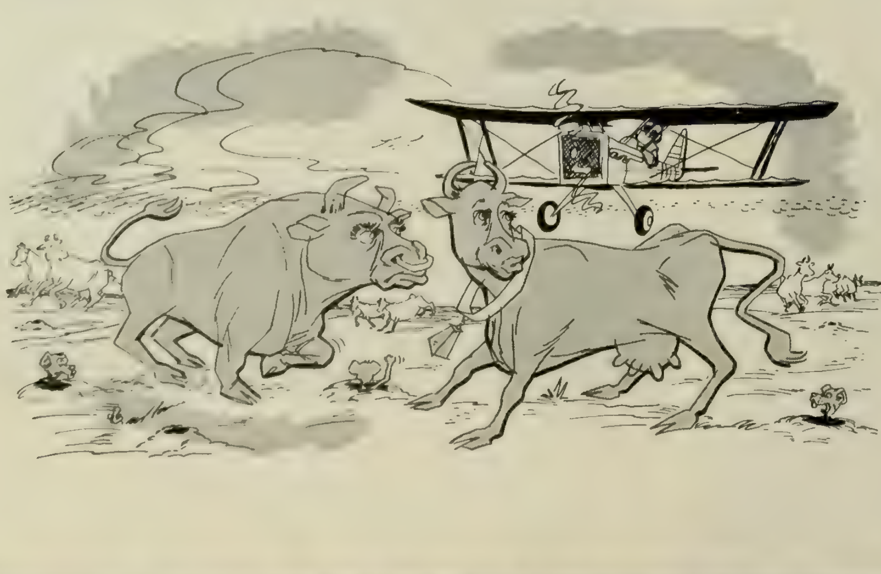
THE OTHER NIGHT I was courageously doing a little hangar flying with some of the boys. The ensuing hairy stories had us pretty well convinced that most of the hazards of the good old days are long gone. No more tearing up the sod with the tailskid when we taxi. Haven't had to check the safety wire on the rigging turnbuckles for a long time. You have to work at it to groundloop the modern bird. Nowadays, landing at a strange field is seldom complicated by a freshly dug badger hole or a stray herd of startled bovines.

Our airfields have gradually evolved into luxurious landing areas, and in spite of the best efforts of us fiery stones, the Fly Safe people have made it pretty difficult to get into trouble on a normal landing.

If you remember the long difficult process of evolution leading up to our present long, wide airstrips, you'll remember that they'd hardly gotten the rhinoceroses off the old 4500-foot macadam strips when someone thought up the jet. Right off the bat Uncle's bill for barbed wire fence and corn fields off the far end of the runway elicited screams of rage from the economy-wise comptroller.

It didn't take long to decide we'd better do our touching down near the front end of the strip, but a few months of this operation and the man came around with the suggestion that since we were now ruining the farmers corn on both ends of the field, he would buy us some more acres so we could stretch that 4500 feet of macadam to 10,000.

Landings today are seldom complicated by a freshly dug badger hole or a stray herd of cows.



"One hundred per cent spare runway ought to take care of anybody," my P-80 colleagues commented.

Alas! By the time we got our new runway, some joker came along with a bigger, hotter machine that gobbles up the runway faster than the visiting brother-in-law sops up your rare old Scotch. So, here we are again, paying for more fences and corn fields.

What Makes a Landing

Down at the far end, the barrier looks like a good answer, but how about these carom shots off the rocks short of this end of the field?

Whether we admit it or not when we're flying a tight formation at the local pasture, you and I both know we make occasional landings we'd rather not talk about; those landings where nothing quite clicks and you're jockeying for position all the way to touchdown, for instance. I find these harder to remember when talk turns to flying than the ones where the whole pattern feels good and you know you've got it made all the way through the landing act.

But, once in a while, when you're sliding down the groove and that warm, "this is one of those good ones," feeling comes over you, suddenly the bottom falls out and you're scrambling around the cockpit looking for a lot of RPM in a hurry. Or, almost as bad, you had it made for a perfect touchdown on the numbers, only the bird has other ideas and flies clear past the first intersection before it gives up!

"What gives? Have I lost the old touch?" I mutter as the smoke billows up from the tortured tires.

I speak with the voice of experience when I say that circumstance is a shattering experience, and I don't like to be shattered. The feeling is something like trying to pass a bogus "5 sixes" to a suspicious neighbor in a liar's dice game—even if you get away with it this time you know it's Lady Luck and not skill that deserves the credit. Maybe this explains the interest that was born sometime ago when during an investigation of a C-124 accident out west for possible weather factors, it turned out that very possibly a wind shift (or shear) was largely responsible. A few questions around the command disclosed quite a few people who had given the matter of wind shifts or wind shear and the landing and takeoff problem quite a lot of thought. As a matter of fact we were sent a very good article on wind shear and landing fighters that had appeared in the ADC monthly flying safety publication, "Archie Newsflash."

The more I looked into the problem the more convinced I became that the best answer to 100 per cent safe landings might be to extend the runways to 10,000 feet both ways from the touchdown point. However, I must admit that this suggestion was received with considerable coolness by everyone including my seven-year-old who pointed out with some scorn that this couldn't be done since our house was in the way.

Wind Makes the Difference

Having tried to solve the problem with amazing lack of success, it seems that the next step is to read you all in on it so you won't get caught short.

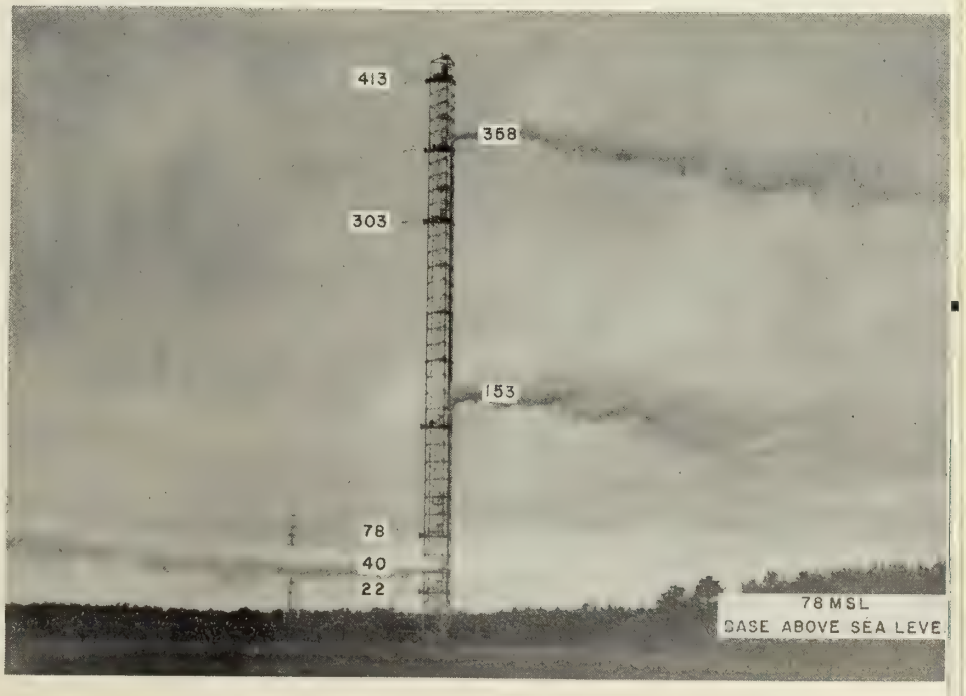
If the air were always calm, you could shoot a few landings in your favorite bird, learn how things look from "high key," "low key" and final, and go on from that day forth making every one right on the numbers. However, weather and wind being what they are, every approach is a little different. (In this discussion I'm only concerned with VFR approaches and landings.) Most of us, I believe, use about the same power setting and airspeed every time we come down the final. The hotter the plane and the shorter the runway the closer the final approach speed has to be to the stall speed in order to get it on the ground and stopped short of the far end of the field.

In order to use our standard approach, airspeed, rate of descent and power setting, we generally compensate for wind by moving the base leg in closer to the field. The stronger the wind, the closer the base leg (within reason). I can imagine a situation at a place like Thule where the windspeed might equal the final approach airspeed of a particular plane. That would be the "limiting case" as the mathematicians say, where, if we insisted in using our standard approach speed, rate of descent and power settings, we would have to roll out onto final directly above the touchdown point. Since our approach speed and the windspeed would be equal, our groundspeed would be zero and we would come down vertically at our normal rate of descent. As a matter of fact, I've seen a version of this sort of thing and I'm sure you have, too, around the local civil airport when occasionally the Cubs and such can be seen hovering or actually flying backwards when there is a stiff wind blowing.

Let's just suppose that one day we have a chance to try this vertical landing operation. We know the wind is strong enough to do it from the amount of flying it took to get into position in the pattern. There we are at 1000 feet over touchdown point, indicating about 120 knots, flying into a 120-knot headwind (zero groundspeed), final approach power set and our normal rate of descent established. As we let down through say 500 feet, we pass through an inversion and discover to our horror that below the inversion there is NO wind blowing. With zero groundspeed and now no headwind to give us flying speed, it feels like someone has cut the string and the rest of the flight resembles that of a manhole cover tossed out of a 10th floor window.

The culprit in the case is wind shear. Fortunately, such extreme shear probably doesn't exist outside of a tornado (which I'm not personally going near enough to investigate).

The fickle wind. Experimental smoke trails off in three directions. Height of the tower is 428 ft.



If such shear were common, you undoubtedly could not give away real estate in the approach zone of an airport. However, it's a rare day indeed when there isn't a little wind shear kicking around.

What Is Wind Shear

If you have the wind blowing one speed and direction here and another speed or direction a short distance away, you have wind shear. You can dress up the definition a little and call the surface where the two winds going in different directions or speeds rub against each other, the zone of shear or the shear surface or shear line, but it all means the same thing. A cold or warm front is a good example of wind shear with the warm air above moving in one direction and the cold air below going in another direction.

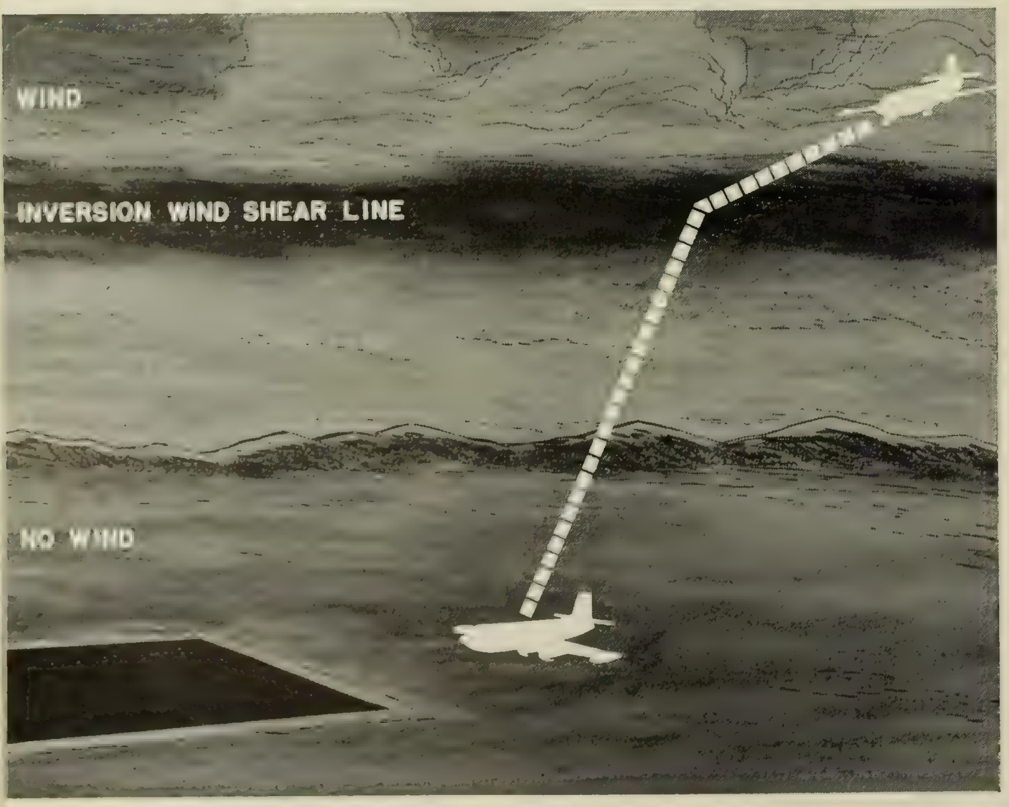
Another good example of wind shear is the strong wind that suddenly springs up just before the afternoon thunderstorm reaches the weatherman's picnic. At one instant it is almost calm, the next it is blowing and raining like mad. The dividing line between the calm air and the wind is a wind shear line.

First, let me explain further why we should keep our eyes peeled for wind shear and then I'll give you a few hints on how and where to search it out.

Even though the extreme example of shear we dreamed up a few paragraphs back wouldn't occur, wind shear between the ground and traffic pattern altitude of 15 to 20 knots is common and a shear of 30 to 40 knots is not at all uncommon in some parts of the world.

In modern high wing loading planes, this situation can cause trouble. If we come down the final approach at 15 knots above stalling speed, and pass through a shear line, where our effective head wind decreases by 15 knots we are immediately at stalling speed. The only way we can prevent a stall is to sacrifice altitude for airspeed or increase airspeed by adding power. In actual practice we simultaneously drop the nose and hit the throttle and if we have enough altitude we drag it on into the field and make a landing. Should our altitude run out before the power takes hold, we land short. The more sudden and severe the decrease in head wind component and the closer to the ground it happens the more chance there is that we will stall in short of the runway.

". . . rest of the flight resembles that of a manhole cover tossed out of a 10th floor window."

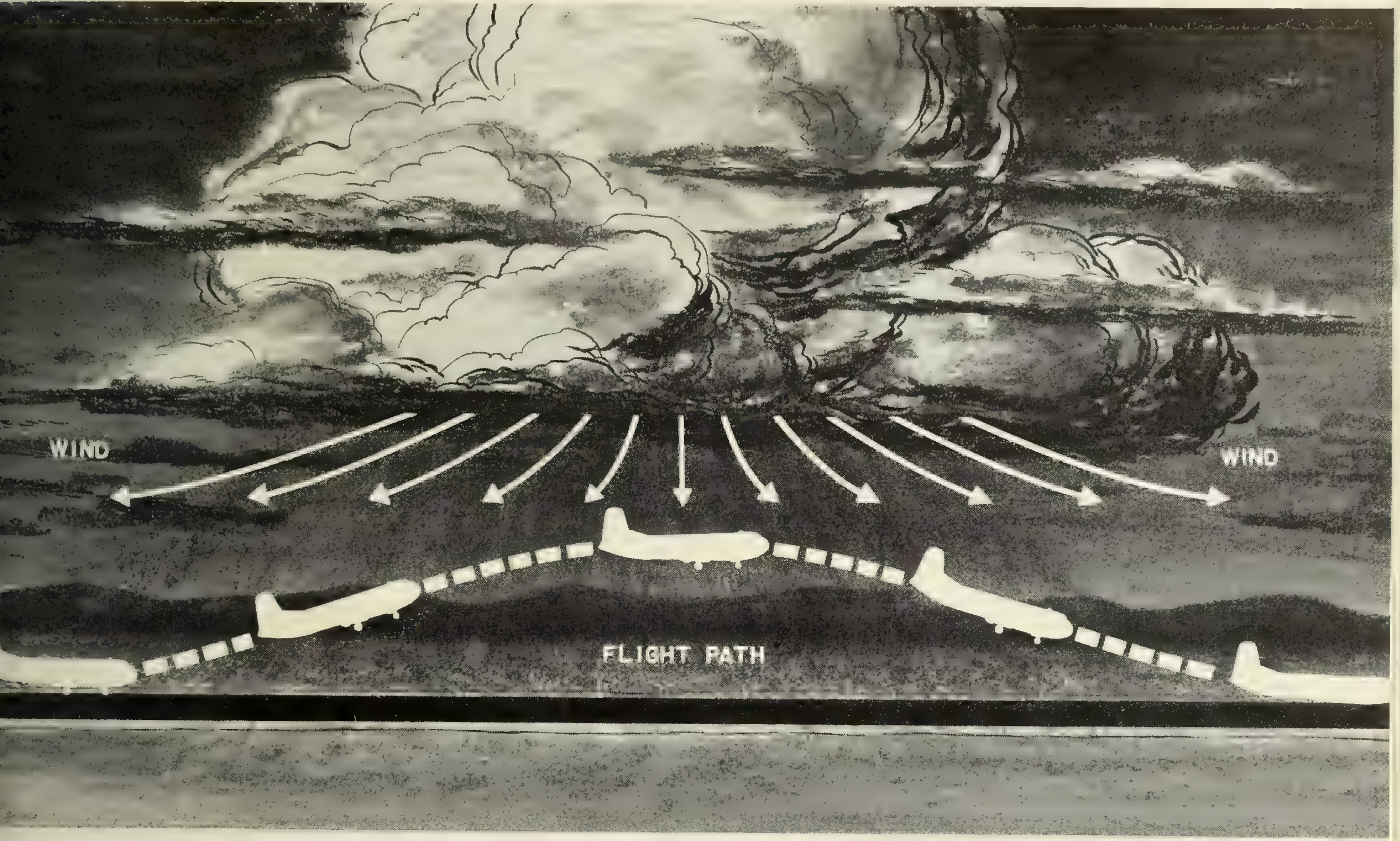


The Two-Edged Sword

This wind shear is a two-edged sword. It can put a good man down in the rocks at the far end of the field too if he's too proud to go around. Suppose our particular bird stalls at 100 knots so we've decided to fly our final approach at 115 knots. On this particular day there is no wind at traffic pattern altitude so we set up our turn onto final accordingly for the usual touchdown on the numbers. Since there is no wind at altitude, our speed over the ground and our airspeed are the same or 115 knots in this case. Just as we get down to the last 100 feet, we pass through a shear line and on the other side of it we find a 15-knot wind blowing right on the nose. Since for several seconds at least the bird keeps blundering along at the same old groundspeed of 115 knots, the 15 knots of wind on the nose adds to it and you find yourself with 130 knots of airspeed. This is pure bonus to the modern low drag airplane and it continues to fly way, way down the field before it gives up and touches down. A T-bird driver friend told me that an extra five knots airspeed over the boundary lights meant an extra 1000 feet of runway on a calm day. This may be a slight exaggeration, but in the absence of any conflicting story I'm inclined to believe him.

The situation begins to get even more binding when you consider the case of the bigger and hotter birds. With the bent wing 84s, 86s, B-47s and B-52s, and the planes to come, we are operating out of many fields where the runways are long enough but don't have a big margin for error. As a result, we are refining our landing techniques, slowing our approach speeds and shooting for a touchdown closer to the approach end of the runway. This leaves us wide open for the wind shear type of undershoot landing, although it's good medicine for the overshoot type.

This wind shear problem can cause a lot of consternation on takeoff too and that is where it is most apt to affect prop types as well as jets. Take for example a heavily loaded transport. Even with maximum takeoff power, it takes several seconds for the airspeed to build up to say, 25 knots above stalling. If you run through a shear line that decreases



"Don't take off or land into the teeth of an approaching thunderstorm if you have any choice."

your airspeed by 20 knots just as your wheels start up, you stand a good chance of settling back with a dull thud. The same thing can happen of course to any type of plane but the faster it accelerates through the critical speeds near stalling the less chance you have of getting in trouble with wind shear on takeoff. That's why the fighter types should have less worry on this score than the heavy transport and bomber jockeys, if you don't pull the fighter off before it's ready to fly.

Where to Find It

If you are convinced that wind shear can put you in an uncomfortable spot, here are some pointers on where and when to look for it.

In the first place, wherever there is a temperature inversion you nearly always have some shear. Since inversions form almost every clear night, near the ground it stands to reason that the late night and early morning hours are a good time to be extra wary. These nighttime inversions can develop within a short time, and a wind shear of 10 to 20 knots within 100-200 feet of the ground can be expected. Semi-permanent inversions stick around places like the southern California coast, Spain and northwest Africa caused by the California and Azores high pressure areas, respectively. Those inversions are generally higher than normal traffic pattern altitude though and so don't often cause a shear problem.

The inversion caused by the Great Plains high is sometimes low enough to cause a traffic pattern wind shear problem anywhere from the Appalachians to the Rockies. However, it is along its western edge where it pushes up to the foot of the Rockies that you can find one of the most startling and perhaps dangerous displays of wind shear.

In a 50 to 150-mile wide belt in the flatlands east of the Rocky Mountains extending all the way from Ladd AFB, Alaska, to El Paso, Texas, blows the famed Chinook wind. Shear-wise, the Chinook causes its trouble when it is trying to move in, and the effect is most pronounced when there is a cold high pressure cell spread out over the plains and pushing up against the foot of the Rockies. What happens is this. The warm, dry Chinook wind comes booming down over the Continental Divide from the west toward Ladd or Malmstrom or Amarillo, where a layer of cold air is covering the area like a tent. The Chinook, being warm, naturally slides over the top of the cold air and right there you have a very respectable shear surface established. As it continues to blow, gradually pushing the cold air back, the inversion (shear line) works its way down toward the surface. Eventually at pattern altitudes and lower you find a westerly wind of as much as 40 knots, while at the surface the wind is nearly calm.

If you happen to make a landing about the time the inversion has worked itself down to within a hundred feet or so of the ground, you can see that you might well be in for some excitement.

Another wind shear situation exists when there is a strong surface wind blowing. Moving rapidly over trees, rocks and buildings, the wind closest to the ground is slowed down so that from 25 to 50 feet above the surface and on up the wind is blowing faster than it is at the surface. This friction induced wind shear *always* tends to make you land short. However, its effect is usually small and since it is only present with fairly strong surface winds when you can afford to shoot for a spot 1000 feet or so down the runway, it is not a serious hazard, provided you remember that it does occur, and you should make allowance for it.

The one other major wind shear producer is the thunderstorm. Flying cross-country on a summer afternoon you've seen a cloud of dust marching along just ahead of the storm. When you are sitting on the ground you know how deathly calm it gets before a thunderstorm, then all at once the wind and rain hit. That's the thunderstorm's most severe shear line. About the only useful advice I can offer is "Don't take off or land into the teeth of an approaching thunderstorm if you have any choice." It's better to wait until the storm center passes over the field.

That's the general picture on what sort of situations produce wind shear lines and some of the reasons why this is becoming more of a problem than it has been before. Since it is a problem, it is important to be able to recognize a wind shear situation when you see one. (See Figure 1.)

How to Spot a Wind Shear Situation

1. Look for an inversion below traffic pattern altitude. Smoke rising in one direction for a few hundred feet, then suddenly turning and taking off in another direction above that, is a sure sign. Smoke from high stacks going in a different direction than that from short ones. (This is common in the case of the big stack near Malmstrom AFB.) A flat topped haze or smoke layer also indicates an inversion. This is usually the best way to spot one of the nighttime wind shear inversions.

2. When the wind at pattern altitude is obviously stronger than that reported by the tower, you have shear . . . so be on your guard.

3. When the tower reports strong surface winds, say over 30 knots, you are apt to have a significant amount of friction-induced shear in the lower 25 to 50 feet . . . so be prepared.

4. When you see a thunderstorm approaching the field, watch out for wind shear. It's certain to be there.

FIG. 1

How to Counteract Wind Shear

1. Landing:

- Make your final approach longer and flatter. (Be reasonable of course, don't drag it in for miles.) This enables you to carry more RPM, making full thrust available to you more quickly, should you need it, and just as important, with the lower rate of descent, you pass through the shear line slower. You then have more time to adjust your speed to compensate for the changed windspeed in the lower air mass, whether it is causing an over or undershoot.

- When the tower reports strong surface winds, in addition to your longer and flatter approach, plan to land a little long. With the strong wind, you will be able to stop in plenty of time even if you touch down a few hundred feet from the approach end.

- When the surface wind is strong and gusty, allow yourself a little extra margin of airspeed on the final.

2. Takeoff:

- Get plenty of airspeed before you pull up the gear. Accelerate to climb speed as rapidly as possible.

FIG. 2

What's Being Done About It?

Frankly, at the present time there is no practical way to measure wind shear above an airfield. Since we cannot measure it, it follows that the tower is unable to warn you of its existence when you call in for landing instructions. A wind shear situation can change almost as rapidly as ceiling and visibility. It follows that to be of much practical value, wind shear conditions would have to be measured at reasonable frequent intervals. Once an hour might be frequent enough but no technique we have available at the present seems to be practical for measurements that often. Various kite or captive balloon combinations have been considered but there are those among us, including myself, who would rather fly through a wind shear than a string of kites and balloons. There are undoubtedly other ways to measure the phenomena and perhaps one of you, the pilots who will have to become more and more concerned about the problem, has an idea that will work. If you do, let us hear from you.

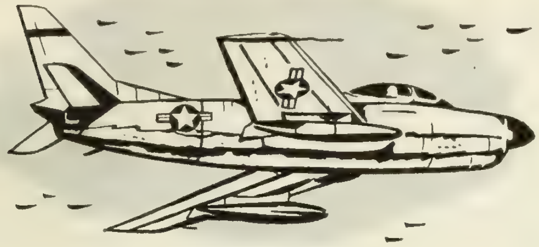
What Can You Do?

Meanwhile, now that you know how to recognize wind shear in its native habitat, you'll find that it can be handled in a fairly straight-forward manner if you spot it before it gets you in a spot.

By following the few simple rules (See Figure 2), you will practically eliminate the chance of your landing too short or too long, or goofing a takeoff because of wind shear. ●

Well Done

KNOWLEDGE TRAINING



CRUISING AT 23,000 feet on a local radar training mission, a muffled explosion rocked the F-86D. Severe vibrations followed and the aft fire warning light came on. Lt. Chester Payne took emergency measures immediately. However, the fire warning light remained illuminated and the aircraft continued to vibrate excessively. Lt. Payne stop-cocked the throttle and established a glide for Perrin AFB, Texas.

In the vicinity of Gainesville, it became evident that Lt. Payne would be unable to make Perrin, so a flameout pattern was set up for the Gainesville Municipal Airport. The longest runway available measured 4700 feet.

Setting up his pattern for this runway, Lt. Payne made a successful landing and the drag chute was deployed to minimize the landing roll.

Inspection of the aircraft revealed the turbine wheel had failed, releasing three blades, which were thrown through the aft section.

Lt. Payne displayed excellent judgment and superior skill, especially for a relatively inexperienced pilot, in safely landing the aircraft under such hazardous conditions. His decision to land the aircraft at an auxiliary airfield on such a short runway and his proper deployment of the drag chute prevented the loss of an aircraft. Well Done!

1st LIEUTENANT

Chester J. Payne

3558th Combat Crew Training Squadron
Perrin AFB, Texas

Obese, stout, portly, fleshy, chubby, bulky, well-fed, well-rounded, large-size, corpulent, heavy and husky. Still they say . . .

Everyone Loves

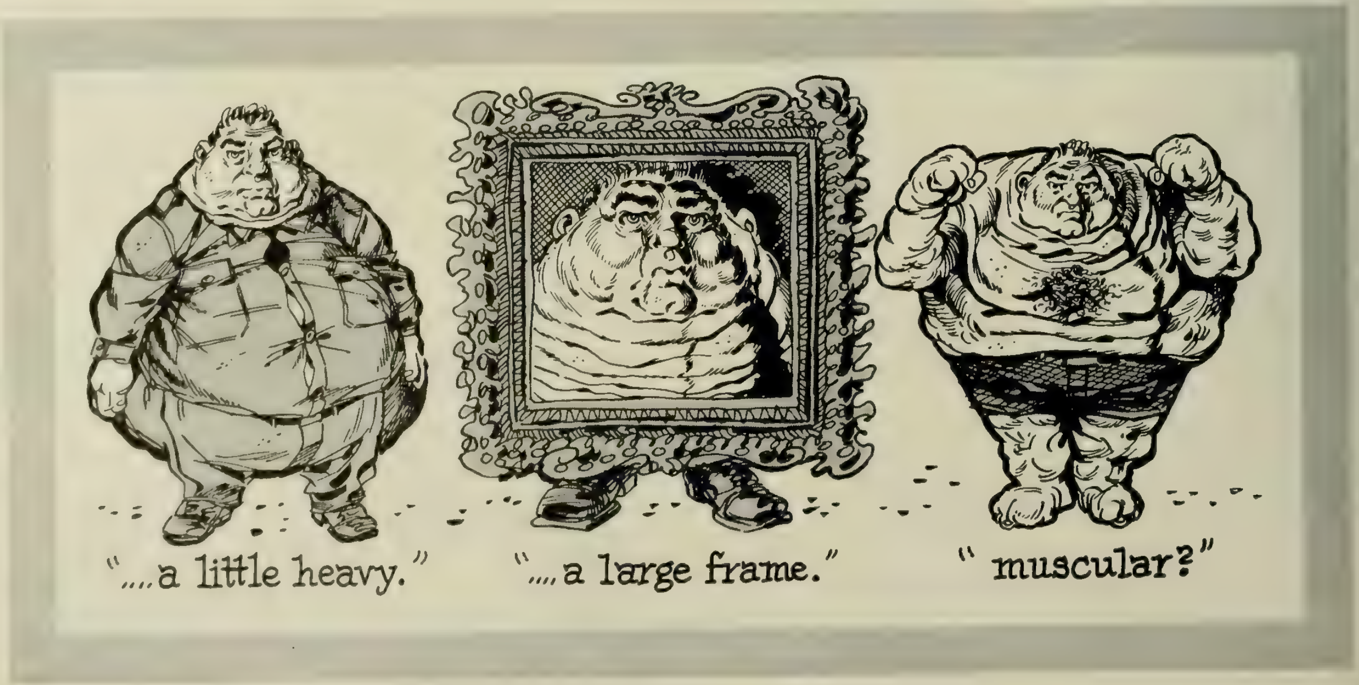
Lt. Col. Harold V. Ellingson (MC)
Deputy Surgeon, Alaskan Air Command

IT'S HARD TO GET a man to admit that he's really fat. Generally, he prefers to think of himself as a little heavy, large framed or muscular. To admit being fat is to admit failure, to acknowledge that you're on the decline—on a highway marked by declining vigor, declining resistance to disease, declining appeal (and declining usefulness) to the female and declining longevity. Many of the ills laid at the door of advancing age actually should be blamed on obesity. Being fat, moreover, has some special hazards for flying personnel in the Air Force.

It is true that good nutrition is essential to good health. And, unfortunately, the public has come to consider a little plumpness as an indication of health. But actually, overweight, even a little, is a health hazard. The more you're overweight, the greater the hazard.

What are the special dangers of overweight for flyers? Fatty tissue is notoriously capable of dissolving nitrogen from the blood, and it is likely to release the nitrogen at high altitude in the wrong way. At best, gas released at altitude can cause bends. At worst, at high altitudes, and especially in case of sudden decompression, the freed bubbles of gas can push little particles of fat into the blood stream, where they can be car-

It's hard to get a man to admit that he's really fat. No matter what you call it, though, it's still fat.



"....a little heavy." "....a large frame." " muscular?"

a Fat Man?

ried to the heart or the brain and cause death.

Two cases of death following explosive decompression at 30,000 feet have been reported recently. Both of these individuals were obese. They were riding in Air Force jets as passengers for special, emergency reasons, without clearance from a flight surgeon. Both went into shock when the airplanes lost their pressurization at altitude. They were unconscious when the aircraft returned to the ground and both died within a few hours after being removed to hospitals. Though these individuals were passengers, the same hazards exist for pilots and other crewmembers who allow their weight to creep upward.

Aside from the special dangers to flyers, overweight carries many additional hazards to everyone, whether he flies or not. Obesity is one of the great and growing health problems of the United States. True enough, cancer is more in the limelight of the public press and has recently achieved the number two standing in the causes of death among our fellow citizens. But obesity does its dirty work under other names, by making other diseases more dangerous or more highly fatal. Let's look at some of the other diseases on the team of killers and see how they are aided by fatness.

Take heart disease, the number one cause of death in the United States. A man's prospects of being struck down by a heart attack are enormously increased by obesity. Even if you're only 10 per cent over the ideal weight, your chances of having a fatal heart attack are 50 per cent greater than if your weight is normal.

Take brain hemorrhage or stroke, which is the number three cause of death in the United States. A man is 57 per cent more vulnerable to a stroke if he's overweight than if he is at his normal weight.

Take kidney disease, which is also high on the list of causes of death. Overweight brings a 72 per cent increase in vulnerability.

Take diabetes. Here, obesity causes

The old treadmill can't match this intake.

a 156 per cent increase in mortality!

Even suicide, farther down the list, shows a similar effect of obesity. The fat man is 29 per cent more likely to take his own life than is one of normal weight.

What do these statistics mean to you, in practical, personal facts? Just this: If you allow yourself to become overweight, you are voluntarily cutting from 5 to 20 years off your life expectancy. You are advancing the day when your widow must take care of the children on the proceeds of a couple of insurance policies that looked generous at the time you took them out, but on account of inflation have become pitifully small. Or, maybe she'll be able to marry a leaner, more vigorous man.

These are some reasons behind the Air Force policy on obesity, as outlined in paragraph 19e, AFM 160-1, (revised 15 December 1953). To quote from this publication: "In flying personnel, weight in excess of the maximum may be considered cause for suspension from flying duty until corrected." By barring flying status or preventing promotion, overweight can really hit us where it hurts the most—in the pocketbook.

What can be done about overweight? The best thing of all is adequate prevention.

A few lucky souls can eat like horses all their lives and remain trim. For the rest of us, there comes an age, between 24 and 40 years, when it suddenly becomes very easy to put on excess weight. You can usually detect this yourself, with occasional weighings, and *then* is the time to cut down on your intake. Eliminate between-meal snacks and foods rich in calories. Beware especially of cocktail parties! At a cocktail buffet, one can easily stow away enough calories to cover his needs for two or three days. A serious and determined drinker can do even worse, for alcohol is an especially rich source of calories.

Once prevention has failed and you've become attached to your fat, removal is a long and painful process. The usefulness of exercise in control of weight is greatly over-rated. The only practical way to eliminate fat is to reduce the intake of food. Once down to a proper weight, you must watch your diet indefinitely, or you will regain the weight.

An "informal" diet, simple avoidance of over-eating, will often suffice to reduce your weight. If not, you should get a definite and well-planned diet from your flight surgeon. He may, if it is desirable in your case, be able to give medications which will help in the initial phases of the diet. But the most important qualities for a successful diet are self-discipline and self-denial. Once you've been fat, you must exercise self-control in eating and drinking for the rest of your life. If you allow yourself to remain obese, you are endangering your health, your career and your very life! ●

Overweight can really hit us where it hurts the most—in the pocketbook.

THE UNITED STATES OF AMERICA
ONE DOLLAR
ONE DOLLAR

One more won't hurt

•

For this impish moppet, maybe yes, maybe no. For the rest of us, there comes an age, between 24 and 40 years, when it suddenly becomes very easy to put on excess weight. "Everyone Loves a Fat Man?" on page 22 treats this problem of overweight in a light yet serious manner.

*U. S. GOVERNMENT PRINTING OFFICE . . . 362333

629.1305
FLYS

MAY 1956

FLYING SAFETY

UNITED STATES AIR FORCE

THE LIBRARY OF THE
MAY 21 1956
UNIVERSITY OF ILLINOIS

. . . all the way?. . . page 4

FLYING SAFETY

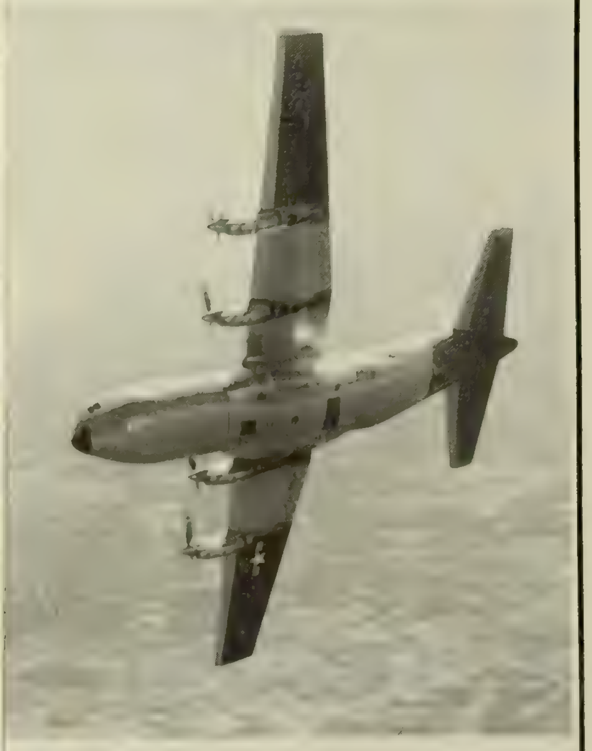
VOL. TWELVE NO. FIVE

- There have been some changes made in GCA parlance. "All The Way?" on page 4 brings you up to date. (NOTE: "Circling" approaches will be clarified in a future issue.)

- Straight from the lads who performed the spin and roll tests on the F-100 . . . page 16.

- After reading "Riser Sharp" you should be able to work the canopy quick release with your eyes closed.

Can you identify this airplane? It will be featured in next month's issue.



Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major Jesse F. Townshend, Jr.

Associate Editor
Major V. R. Stutts

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby
T/Sgt. Chester D. K. McCubbin
T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune
A/2C Al Fagerwick
T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

	Page
Crossfeed	2
All the Way?	4
Who Dat Man?	9
The New Trim Look	10
Well Done	13
Keep Current	14
Parade of the Centuries	16
Riser Sharp	22
The Professional Approach	24
Rex Says	26
Sound Off	28

★ ★ ★

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, July 6, 1954. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

Flying Safety Officers
KIT
DIRECTORATE FLIGHT SAFETY RESEARCH
OFFICE OF THE INSPECTOR GENERAL, USAF
NORTON AIR FORCE BASE, CALIFORNIA

YOURS FOR THE ASKING

- **Studies**
- **Scripts**
- **Skits**
- **Helps**
- **Hints**
- **Hopes**

If you are a Flying Safety Officer, you should be receiving this special kit every month. Detach the coupon below and get on the mailing list.

We need your current military address in order to streamline our direct mailing list. This will enable us to send you items that are "hot" current topics. Please clip and send direct to Supervisor of Flight Safety Publications, Directorate of Flight Safety Research, Norton Air Force Base, California.

Name & Rank ______________________________

Organization ______________________________

Address ______________________________

Are you a graduate of the USAF Flight Safety Officers course, Univ. of So. Calif.? Yes ☐ No ☐

CROSS FEED

LETTERS TO THE EDITOR

Mighty Hard Paint

The suggestion by Captain Johnson from Wright-Patterson regarding concrete gear-down reminders sounds excellent but I have wondered if this might not lead to some of the same problems experienced at Midway Airport in Chicago where concrete runway marking numerals were at least a contributing cause to one accident.

Major Crispin M. Wood
483d TCGp Maint. Officer
APO 75

You've got a point. The moral of this story is to paint numerals with paint . . . not concrete.

★ ★ ★

Sounds Good

A short time ago I read a newspaper account of a harrowing experience a jet fighter pilot had on a night flight. He was in the process of consulting his Radio Facility Chart when he dropped his flashlight. In attempting to recover it, he lost control of his aircraft. He was flying at 30,000 feet at the time and recovered only a few thousand feet from the ground.

I wonder how many pilots and aircraft have crashed while flying at night for the same reason?

I have talked to another pilot who had a similar experience. His solution was to tie a string around his flashlight and hang it around his neck.

I have another solution to the problem. I would like to suggest the possibility of printing Radio Facility Charts and navigational charts for night operations with an ink that can be read under black or red light. This would eliminate the need for a pilot, particularly a fighter pilot, from having to control his aircraft, hold onto a flashlight and read a chart page all in the same operation. It would eliminate also the loss of night vision due to the use of a white light in the dark cockpit.

Lt Col Robert B. Ross, USAFR
3004 Parkway Terrace Drive
Suitland, Maryland

An interesting thought. Our printing editor is filling in the business reply card that comes in the Radio Facility Chart and forwarding it to the ACIC.

★ ★ ★

Bully for You

I've read with great interest the REX article on page 27 of the November 1955, FLYING SAFETY.

To go further into the matter of eliminating superfluous chatter during position reports I don't believe it is necessary to say "over Litchfield." Litchfield alone is sufficient if you are over it. If you are not over it, you are simply estimating your position and CAA, or ARTC, is just as apt to list you as "position unknown" under such a condition. If passing a station and you report in "abeam" or crossing a leg, they most definitely are interested if you give them "six miles abeam southeast," and so on, but mention "radar fix."

I also believe "at" can be eliminated in the phrase "at eight thousand," as well as the word "estimating." After all, when saying "Pullman one four one eight," you've given your estimate.

Now we come to one I feel is really needless. That is, saying the phrase "instrument flight plan." I personally fail to see where that is any more effective than saying "IFR." There can be little to confuse IFR with Vee FR. I should greatly appreciate your comments on this problem.

I thoroughly enjoy your publication and feel that you do a world of good. Yours for continued success.

Capt. Albert L. Catallo
SAC Arctic Research Indoc. Br.
Westover AFB, Mass.

Thanks for your thoughts about the magazine. Following the position reporting example in the FAC. Chart would eliminate much excess chatter.

★ ★ ★

Pinned Down

Reference is made to page 1 of the February issue, FLYING SAFETY, "Look Before You Leap." My experience on jets has been to leave landing gear down lock pins and tiptank safety pins installed until the pilot is strapped in and the engine is running.

I believe it is an oversight that you listed these two items as part of the pilot's walk-around inspection. The main reason to leave the gear down locks in on a T-Bird until the engine is running is for hydraulic pressure. It's possible I may be out-dated on this because I haven't been assigned to jets since June, 1955.

M/Sgt. Joseph M. Hurl
465th Fld Maint. Sq
APO 253 New York

You are right, pins should remain in until after start. Our lead question was, "would you leap in this bird?" Our T-33 expert had that in mind when he included pin removal.

★ ★ ★

Flow Gently

What about the fuel flow meter in the story "Hazards Can Be Hidden" in the October issue? It was very interesting to me, since I'm an ex-C-54 jockey of some forty odd hundred hours total and about 2000 IP hours in them. I did not find any reference to the fuel flow meter in your story. This instrument was always important to me (and used in SOP) because a leak will increase fuel flow. Was interesting too that the pilot had not been thoroughly taught, "What would you do if you saw a fuel pressure drop, fuel flow increase and engine continues to operate normally?" The answer we know. I was taught this in 1945 in transition school. If there be doubt of second guessing, refer to C-54, 42-2756 major accident, October 1953, at Keesler AFB (Pilot's Statement).

The picture in the magazine, as best as I can determine, has a "BULLY BEEF" Sixth Troop Carrier Squadron insignia. Interesting, because I was a member of that Squadron once. Is this the aircraft that was involved?

Capt. June M. Kennedy
Base Flt. Maint. Officer
3627th Fld Maint Sq
Tyndall AFB, Fla.

Sound advice on using the fuel flow meter. Guess everybody didn't go to the same school that you did. As to your question—negative!

★ ★ ★

Fly Right

An incident reported in the "Rex Says" section of FLYING SAFETY (December, 1955) has caused some concern to several academic instructors at this base. The write-up in question appears on page 24 and relates to the tale of a pilot who appears to have been mis-led or confused during a VFR flight "up a northeast numbered airway."

According to the report, said pilot was flying "correct quadrantal altitude" for off airways flight (northeasterly direction) and upon determination of this fact did change altitude by climbing.

From here, it appears that he was in the right to begin with, as proper quadrantal or airway altitudes (for condition specified) are the same—namely odd thousands. A possibility exists that the segment of airway involved may have fallen in the southeast quadrant; if this is true, then both aircraft were being flown at improper altitudes.

Considering those facts, it appears that our pilot was too quick to accept sole responsibility for the error. The action by the copilot in averting a collision was commendable. Some criticism of the pilot of the second aircraft appears to be justifiable, as he could not have been at an appropriate altitude.

We agree that too little is understood by too many when correct cruising altitudes are involved, and would like to point out that AFR 60-16, paragraph 32d, states that quadrantal altitudes (outside control zones and areas) are based on "Magnetic Course" instead of "Magnetic Heading" as quoted in your write-up.

Lt William E. Jacques, Jr.
Norman S. Orloff
Academic Instructors
Greenville AFB, Miss.

You've spotlighted a very pertinent point. You sum it up concisely when you say that too little is understood by too many, when referring to correct cruising altitudes. Better see page 3, Radio FAC Chart.

★ ★ ★

Where's the Bottle?

In your December 1955 issue of FLYING SAFETY you printed an article by Lt. Carter, entitled "The E in P. McCripe," recommending the proper routing of the long hose on the H-2 bailout cylinder. To a certain point I agree with Lt. Carter; however, I can not agree as to the location of the bottle itself.

I quote from T. O. 15X1-4-2-1, paragraphs 3 and 4: "An alternate method of carrying the cylinder assembly when used in conjunction with the back style parachute is to attach the carrying back to the right hand wing flap panel of the parachute pack assembly." To do this the inspection data pocket must be transferred to the left hand wing flap, then the straps on the carrying bag will be cut off and the bag sewed to the wing flap. This method has been in use in our organization for over two years.

Our organization also uses the F-1A automatic parachute release which is located on the left side of the parachute. If, in an emergency, the pilot had to use his oxygen bottle on bailout, upon reaching for the ball handle to activate the bottle, he might, in his haste, pull the automatic release if his equipment were fitted as Lt. Carter suggests. He would then be in real trouble.

I also noticed, in the picture Lt. Carter submitted, that the oxygen mask hose was twisted to the *left* so that the connector assembly can be connected to the combination bailout connector assembly. All oxygen masks that were ever used by our organization had the combination bailout connector assembly turned to the *right.* I doubt if, in an emergency, a pilot would have the time to twist his oxygen hose before going over the side.

I also believe that in a bailout at altitude the oxygen supply would be cut off by routing the bailout cylinder hose under the harness assembly, as Lt. Carter shows in his picture. We routed our hose assembly up the right side of the parachute, under the top of the opening band protector flap, over the shoulder, down the right side of the harness assembly, and under the keeper located below the canopy release fitting, thereby having nothing to obstruct the flow of oxygen to the mask.

If this letter will help in some small way to save a pilot's life, then I will consider my time well spent. Following the tech order is still the best answer to the problem.

T/Sgt Morgan H. Dunbar
457th Strat Ftr Sq
Tinker AFB, Oklahoma

Thanks for your time and your letter. You gotta go with that T. O.

★ ★ ★

Jolly Well

Reference is made to the article entitled "For Low and Slow," in the Crossfeed section of the February issue of FLYING SAFETY.

The British have an excellent system for both day and night airfield identification. The station call letters are painted in a prominent spot, usually near the "Wind Tee" for day identification, and a rotating red beacon flashing the letters in code at night. For example: Wright-Patterson: "FFO," Bolling: "BOF."

Our Radio Facility Chart makes it easy enough to correlate them, but of course this system is still only good for VFR flights.

Captain John C. Funk
Wright-Patterson AFB

Solve the IFR angle and you win a free subscription.

Make sure of your clearance. Full stop, left, or for a low approach, above.

Whether you fly jets or reciprocal type aircraft, it is important that you understand correctly all GCA phraseology. Are you sure that you have been cleared . . .

. . . all

I SLAMMED the steel door shut and waited for my eyes to adjust to the darkness of the interior of the GCA trailer.

"Do not acknowledge any further instructions. Distance from touchdown is 5½ miles. Your heading is zero four zero. Check wheels down and locked. Maintain 1200 feet."

I walked toward the sound of the voice which was at the far end of the narrow aisle. I sidestepped around an airman who glanced up at me as I entered the trailer.

I asked, "How's business?"

"Everything from 33s to 124s. Sgt. Kline, the final controller, has been busy since eight o'clock this morning," he answered, swiveling in his chair to keep me in sight as I felt my way along the steel sides of the room.

"Three quarters of a mile from touchdown. You are on glide path. Half a mile from touchdown, slightly high on glide path. Down a little. You are now passing through GCA minimums. You are over the end of the runway. Take over visually for your landing. Final controller. Out."

I looked at the scope. The moving blip merged with the solid background reflection. Sergeant Kline acknowledged the comments of the pilot and took off his headset. Briskly, he rubbed his ears.

"Man, what a morning! They must be stacked clear up to 15,000. Anything I can help you with?" he questioned, still rubbing his ears.

"Yes, but it looks as if I picked the wrong morning to talk with you," I answered. "I'll just look and listen awhile. There are some questions about GCA approaches and equipment I would like to ask when you have the time."

A curt voice over the loudspeaker interrupted. ". . . final controller, this is Air Force 55890, how do you read?" I remained silent.

T-33 Low Approach

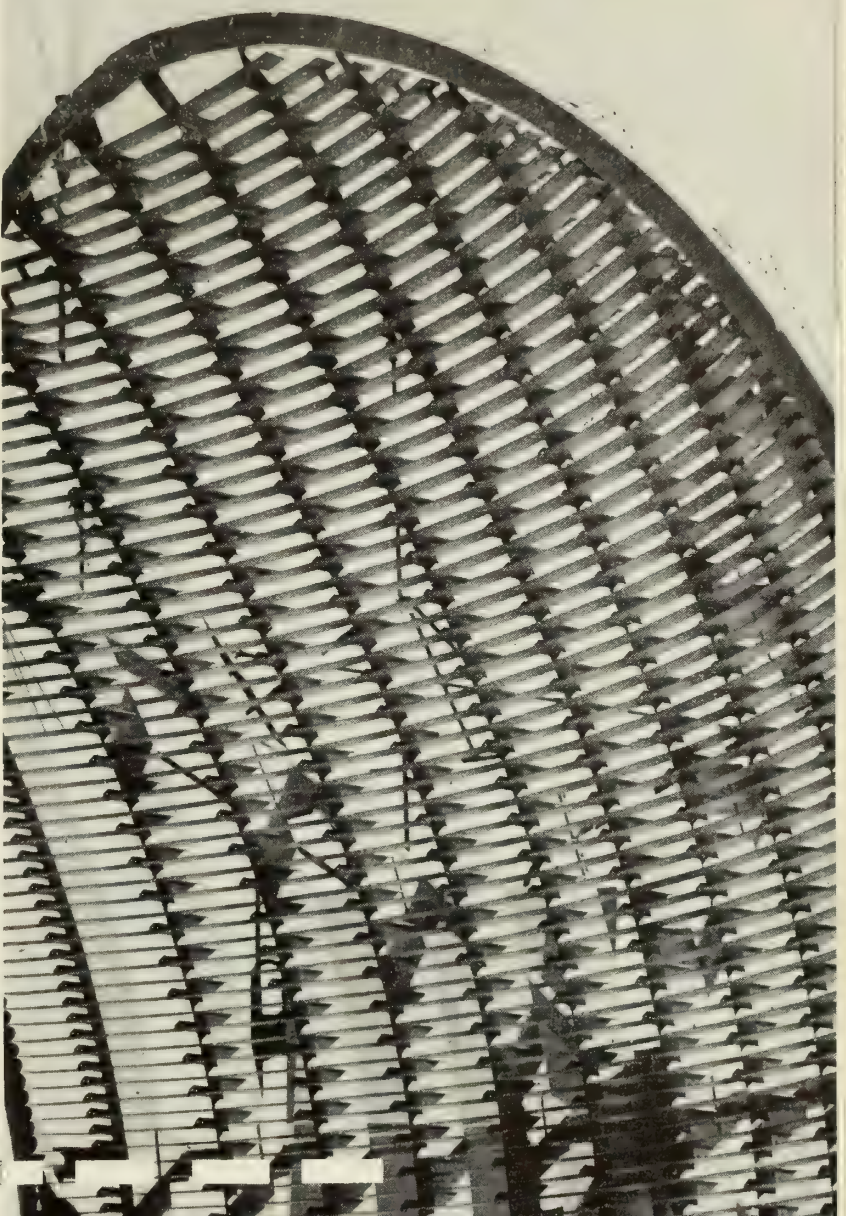
He turned back to his scope, donned his headset again and answered.

I watched him make the run and he did it without a hitch. During the break, I managed to firm up a meeting with him.

We met the following day, along

Any inbounds? Controller checks schedule.

the way?



with Captain Powers, operations officer of AACS.

Sergeant Kline started out. "I wish that you had been looking over my shoulder recently when a T-33 pilot made a low approach run. You know our console set-up? There are two positions to work, surveillance and final. I was working the final approach position.

"The ceiling was ragged at 1000 feet with light intermittent rain showers. Visibility was three miles. Our scopes were lined up for runway 12. However, the wind was out of the northwest. The active runway was 30, and we don't have an approved radar approach to that one.

"The T-33 pilot was at 3000 feet on a heading of 080 degrees when he contacted us on channel 17. The search operator had him turn to a heading of 300 degrees and to descend to 2000 feet. On his downwind leg, he was told that he had been cleared for a low approach only.

"He was asked what his airspeed would be on final. After his answer, he was directed to switch to channel 18; then, I took him over. He had been given the weather information and had acknowledged it.

"On the final approach in addition to his heading and altitude corrections, I stated, 'You have been cleared for this low approach.' As he passed through GCA minimums, I informed him of such and asked, 'Do you have the field in sight?'

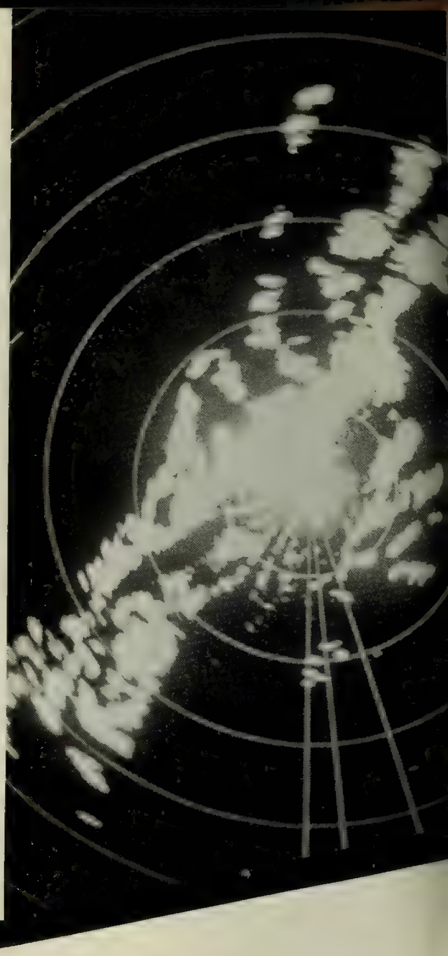
"He answered, 'Roger.' I told him then that he was cleared to the tower frequency for instructions.

"I continued to follow him on the scope. Instead of contacting the tower, the pilot landed downwind. He must have assumed that he had permission to land. Fortunately, the wind wasn't blowing too strong and he stopped before going into the barrier."

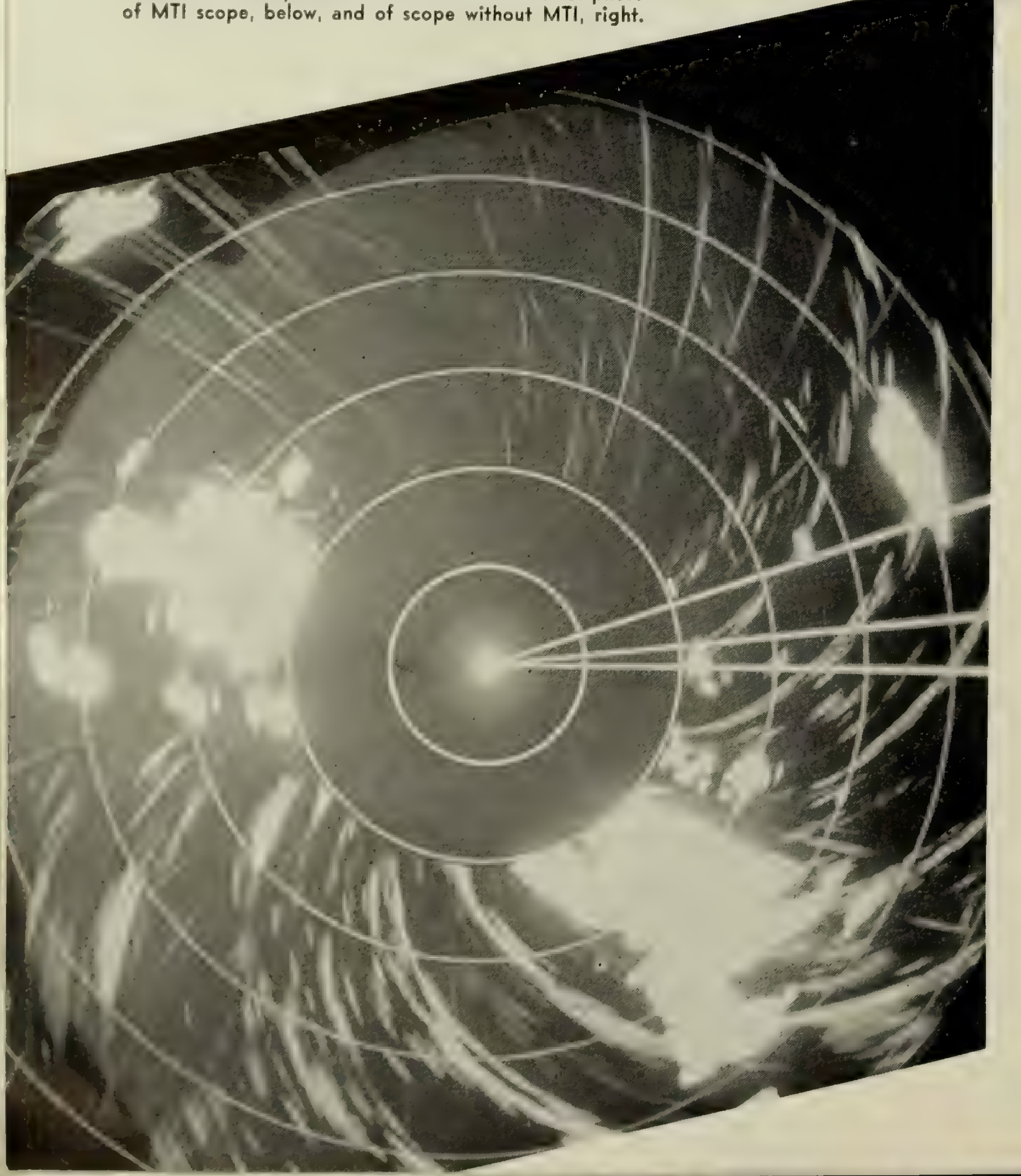
I wondered about Sergeant Kline's story. Why didn't this pilot switch to tower frequency? Did he misunderstand what the term "low approach" meant? I was curious.

I asked Captain Powers to elaborate on the types of approaches a pilot might receive from a GCA facility.

He commenced, "The types of radar runs for a pilot to know about are air surveillance approach and precision approach radar." *(Editor's note: Hqs AACS has directed their Air Traffic Controllers to use only the phraseology, precision approach or surveillance approach, when communicating with pilots regarding the type radar approach being conducted. Terms such as PPI, ASR, PAR, SAR and Search Approach will no longer be used.)* "A pilot can make a low approach using either airport surveillance radar equipment or the precision approach radar equipment.



The MTI (Moving Target Indicator) eliminates all targets that do not move and has the advantage of cutting out ground clutter on the scopes. Note difference in center of photo of MTI scope, below, and of scope without MTI, right.



"During all radar approaches, tower instructions will be strictly enforced. Tower controllers will be advised by the surveillance radar controller operator when an aircraft on a radar approach reaches a point 10 miles from touchdown. That means either the plane is on a base leg or on a straight-in approach.

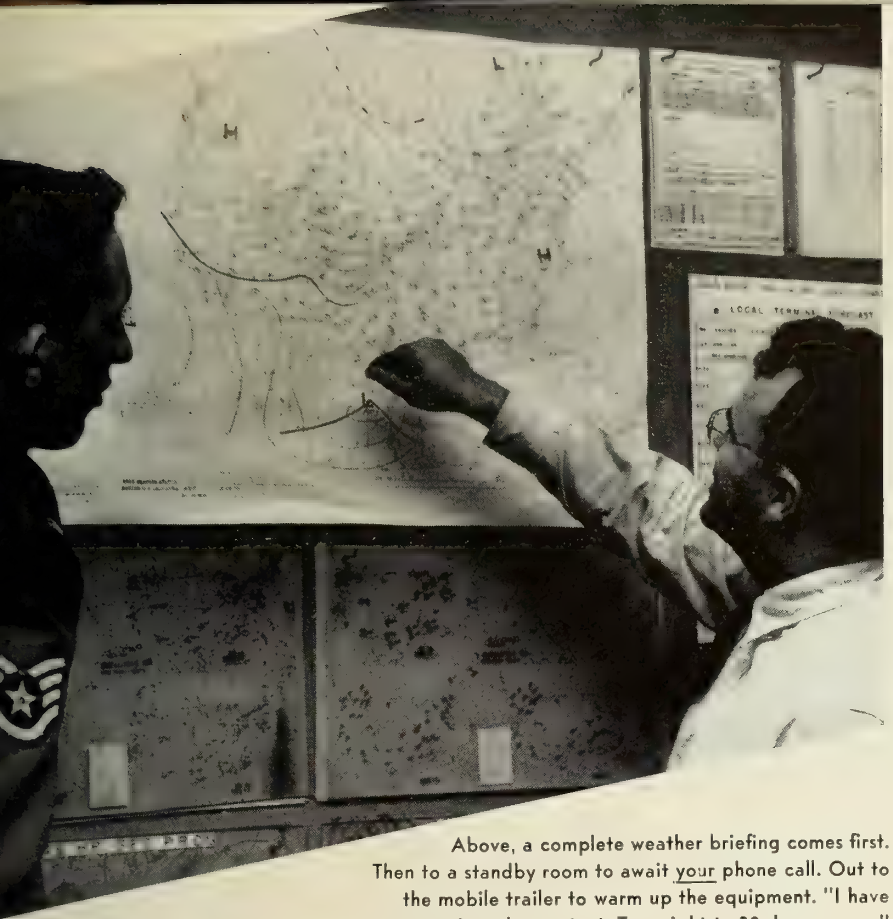
"When the aircraft has reached a point five miles from touchdown, final clearance for the approach will be requested by GCA from the tower.

"In no case will the radar controller continue an approach without receiving final landing clearance. If he doesn't receive this final okay, then he will break off the approach immediately and advise the aircraft to go around or follow the missed approach procedure."

Tower Permission

I stopped him. "Let me get this straight. The tower gives the GCA controller permission to tell a pilot that he is cleared for a landing, whether it be a touch-and-go or a full stop landing?"

"Right," Captain Powers replied. "The pilot must realize that just because he has been cleared for a low



Above, a complete weather briefing comes first. Then to a standby room to await your phone call. Out to the mobile trailer to warm up the equipment. "I have you in radar contact. Turn right to 30 degrees. . . ."

approach, that doesn't mean that he is cleared to land. He should realize that after a GCA low approach it will be necessary to switch to tower frequency for landing instructions. The tower, not GCA, controls all takeoffs and landings."

"What is the difference between a surveillance approach and a precision approach?" I queried.

"A surveillance approach was previously referred to as a PPI approach. In this type of approach the radar controller provides the pilot with heading information only. Pilots will be given range information and prescribed altitudes. For example: The pilot will be advised when to start his rate of descent. As he reaches each mile marker on final the controller will advise that he should be at a certain altitude.

"By checking his altimeter, the pilot is able to adjust his rate of descent accordingly. The minimums for this type of approach are higher than the precision approach."

I turned to Sergeant Kline. "What about precision approach radar?"

"On a precision approach the final controller issues control instructions based upon positive radar data, heading and altitude, so that the aircraft can be kept exactly on the glide path until the approach or landing has been completed. At any time the aircraft target varies from the established glide path in excess of certain prescribed minimums, the controller will direct the pilot to execute the missed approach procedure."

I winced. I remembered the time I was tooling down the glide path when the radar controller told me to execute the missed approach procedure. Startled I took a quick glance at the copilot and yelled, "What's my missed approach heading and altitude?" That taught me a lesson. When the GCA operator issues the missed approach procedure I copy it down. Why? Because the missed approach procedure he gives to you is not always the missed approach procedure that is published in the letdown charts.

Gyro Out Approach

"Anything else on approaches before we get into improper pilot flying practices?" I asked.

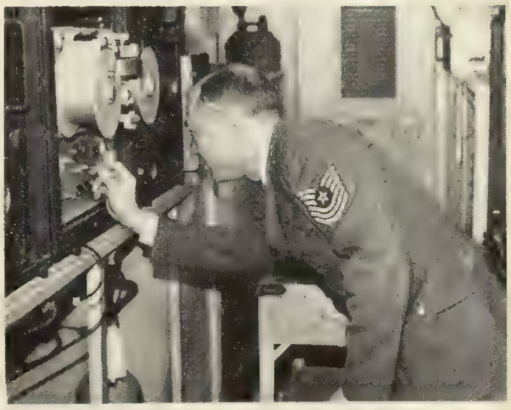
Captain Powers continued, "We have what we call an inoperative gyro letdown. If a pilot tells us that his directional gyro is out, here's how we handle him:

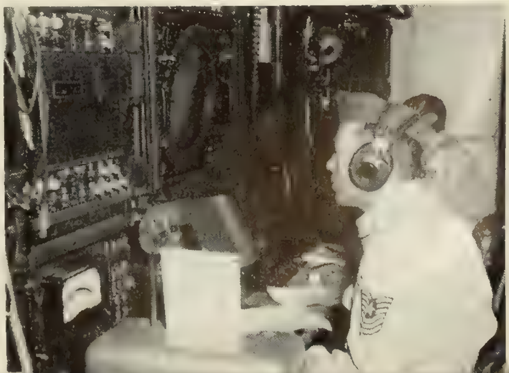
"Make all turns standard rate. I will start and stop all turns. The command of execution will be the word NOW. I will say 'Turn right—NOW. Roll out—NOW. Is this understood?" I nodded agreement.

Next, he explained how radar controllers handle an aircraft whose transmitter is inoperative. The radar controller states that he has not received any acknowledgment to his transmissions. He then says, "If you follow my instructions we will complete this approach. I will repeat all instructions twice." The radar controller then follows the movement of the blip to confirm that his instructions are being followed.

What are some of the improper flying practices that pilots follow which might get them in trouble?

Captain Powers answered, "First, this business of preliminary landing information: In addition to traffic data and field conditions, the radar controller will furnish the pilot with the active runway, field weather, altimeter setting, missed approach procedure, any special information and





Located near the runways, mobile trailers are symbolic of GCA. New RAPCON facilities are housed in buildings.

minimum altitude for the approach. Normally, this will be given prior to the time the aircraft reaches the final approach gate."

Sergeant Kline interceded. "Believe it or not, but I have given this same information to pilots and have had them come back with 'Roger, gear down and locked.' I think that pilots have heard the same phraseology so often that they sort of blank out when we give this preliminary data to them."

Captain Powers nodded agreement and continued. "Because of this weakness, the Air Force and Civil Aeronautics Administration are changing the procedures to require the controller to give the pilot his missed approach instructions at the time he needs them—Climb to (altitude). Turn right left to heading."

"However, it is not necessary or desirable for the pilot to read back the weather or missed approach procedures. All that is required is to repeat all headings and altitudes and the altimeter setting. Just acknowledge receipt of the other information.

"Another phase that pilots can sharpen up on is the turn to final approach. Some pilots start their turn too late, overshoot and then wonder why they don't hit the center line. Other pilots will stand the aircraft up on a wing and of course they undershoot the final.

"Same thing applies to glide path corrections. They are supposed to be slow and easy, not resembling dives or climbs."

An interesting point came up when radar approach minimums were discussed. Seemingly, when a pilot hears this phrase, the blip begins invariably to move from side to side, indicating that the pilot is off instruments and visually searching for the runway. In multiplace airplanes a little cockpit coordination would straighten this out. If the copilot cannot see the runway you may as well stay on the gages and execute the missed approach. Transitioning from instruments to outside and back is bad business.

Controller Training

I was interested in the training that a radar controller receives and any new equipment that he might be using.

"A radar controller first has eight weeks of basic air traffic control school. Then, nine weeks of special radar schooling and several months of OJT follow before he is permitted to control aircraft in IFR weather. He must pass the Air Force written and practical tests for his rating.

"Most radar controllers average about 60 hours of duty per week. Why that much? Well, it is a very critical career field and experience is at a premium. Many of the senior controllers in ATC radar facilities are rated Reserve officers and know quite a bit about aircraft and their problems.

"In the past, most of our equipment has been the old MPN-1.

"Bases now are being equipped with newer equipment, the CPN-4, which includes the Moving Target Indicator (MTI). It eliminates all targets that do not move and has the advantage of cutting out ground clutter on the scopes. Incidentally, glide path corrections will be given as 'high' or 'low,' 'slightly high' or 'slightly low' instead of 'by feet.' "

Also, the precision scopes are combined into one azimuth-elevation scope. This way one controller can work final instead of the two required by MPN-1. The CPN-4 has better altitude coverage, better communications and jet aircraft are easier to pick up.

RAPCON centers incorporate the latest improvements with GCA facilities. (See FLYING SAFETY, January 1956.) They are located away from the runways and are housed in buildings. They have three surveillance scopes and two precision scopes.

I looked at Captain Powers and Sergeant Kline. "That's about it," they chorused. "Tell pilots to visit us when they have an hour to spare." ●

....who dat man?

YOU'VE HEARD THE story about the little man who wasn't there, haven't you? He's there, all right. If you're flying in, through or adjacent to an ADIZ and either by your own negligence or circumstances beyond your control, you cause the bells to ring and the lights to flash and the jets to roar at an ADC base, you best start looking around. Why? Because that little man is going to be there, but quick.

You're right. That little man is an ADC interceptor fighter pilot. Just like ham and eggs, ADIZ violations and interceptions go together. Here's the why, who, how and what you should know about ADC intercepts.

Why is a pilot intercepted? Intercepts are made in an ADIZ when it is not possible to correlate the observed radar track with flight plan information available at the radar site. Outside an ADIZ, intercepts or rather identification checks are made when the track, because of observed actions, may create suspicion. These actions may be a combination of speed, altitude, maneuvers and proximity to or turning toward a critical target.

Besides a track that is suspicious, you may be intercepted because of a communications lag or mishandling of your flight plan. Radar site controllers coordinate closely with ARTC centers on flight plans to confirm correlation. However, no track is taken for granted. If you don't fly as filed or if you are not within the prescribed tolerances, that little man is going to pay you a visit.

Who starts this intercept and what are the tolerances? The radar site controller responsible for identification in the particular sub-sector, orders the intercept. An observed aircraft for which a flight plan is not on file or one which is outside the tolerances in time and distance is declared an "unknown." These tolerances are:

- Time—plus or minus five minutes from an estimate over a reporting point or point of penetration.
- Distance—ten nautical miles from centerline of proposed route, if entering or operating within domestic ADIZ or entering the United States across International Boundary ADIZ. Twenty nautical miles from centerline of proposed route if the aircraft is entering or operating within a coastal ADIZ.

The radar controller is allowed two minutes to establish a track and one minute to classify it as "friendly" or "unknown." If it is an "unknown," an intercept is initiated. After the scramble is ordered, and if the aircraft is identified as friendly, the fighter pilot is instructed to return to his base.

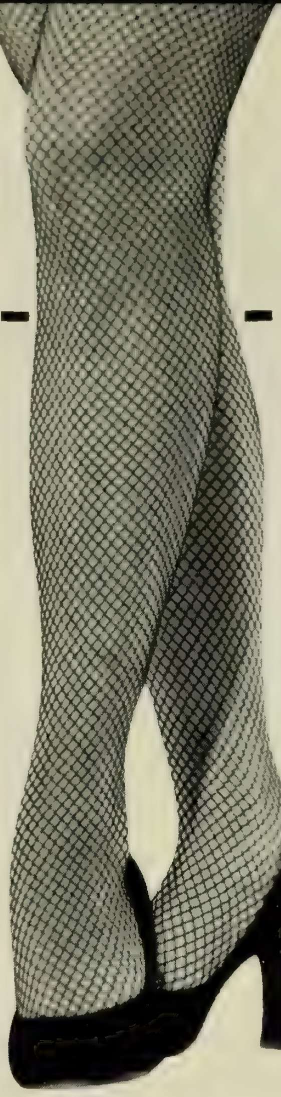
How do you know you have been intercepted? This may come as a surprise, but usually you find out through a formal violation notification by Flight Service. Here is how it works:

Suppose you are tabbed as an "unknown." A scramble is ordered. The jet interceptor pilot is vectored within range of you. He flies only close enough to scribble down your aircraft serial number. He relays this and any other pertinent information to the GCI controller. Some ADC interceptors are equipped with cameras. If they are, a few feet of film is made of your aircraft. Then he breaks off. When he makes his break, you may get a glimpse of him, but in most cases you won't. He is not there to signal you to land, as is often believed, but to make positive identification. Neither he nor ADC is interested in where you will be landing. Don't dive away or turn on an Aldis lamp into an interceptor pilot's eyes.

Upon landing, the interceptor pilot is required to sign an affidavit concerning the actual interception. The violation is then sent to his Air Division headquarters and thence to Flight Service. You'll receive the violation notice in the mail after your commanding officer has read it.

During IFR conditions, different interception procedures and maneuvers are used. These special ADC techniques are of a classified nature.

The interceptor pilot has a job to do and he does it. You actuate him when you violate an ADIZ flying restriction. It's easy to keep him off your back. File your flight plan and fly it. ●



the New Trim Look

Alfred W. Reiter

ACIC, USAF

I AM ASSIGNED to the Aeronautical Chart and Information Center and have frequent occasion to visit various Air Force bases to determine requirements for aeronautical charts. On a recent visit to a large base, I ran into an Air Force Major with whom I had had several past contacts. While leaving base operations, he invited me to have dinner with him at the officers club.

About the time we came to our cigarette course, he flipped his match toward the ash tray, leaned back and said, "You know, I've got a gripe, and since you are with the outfit that produces aeronautical charts, maybe you can explain something to me."

"I'll certainly try," I replied. "What's your problem?"

"Well," he continued, leaning forward, "why must we spend hours cutting margins off of charts, taping, trimming, folding and whatnot and wasting time that could be spent to better advantage for briefing, flight planning and aircraft checks? And why waste the money invested in the chart scraps that are all over the operations floor?"

I broke in to slacken the pace and to take time to collect some well scattered thoughts. I was dealing with a senior pilot with many hours of flying time. Apparently, many hours of chart stripping time, as well. I decided the questions needed a complete answer and began with, "Perhaps its does appear, on the surface, that we waste your time, and Air Force money, but actually there is more to this than meets the eye. Let's go over this thing and really look into the problem.

"...spend hours cutting margins off charts..."

"First, I'm sure you'll agree that many flights do not require strip coverage. Local flying or short range flights may involve only one or two charts. Other operations are area type, such as close air/ground support or interception. You don't know in advance what your course will be."

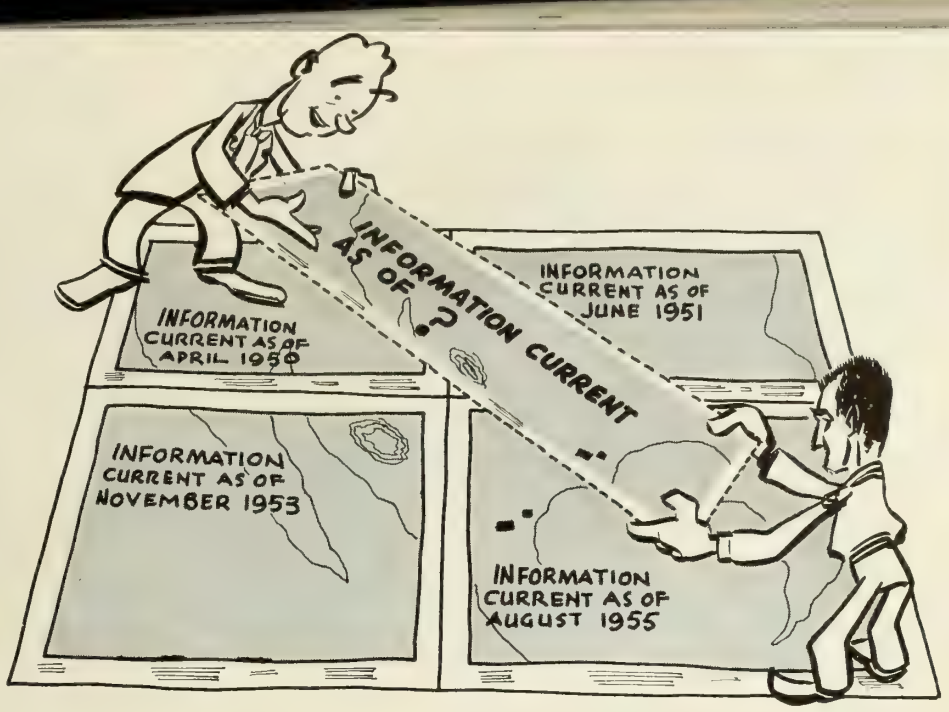
Not even slightly satisfied, the Major came back with, "This is true. But how about the many flights where we do know our course in advance? These flights include every type from administrative flying to SAC long-range missions."

"That's one of the difficulties," I broke in again. "Commands like MATS and SAC have so many bases and so many destinations, we'd be faced with producing thousands of strip charts for each route. In addition, terminal points may change or new ones may develop. Besides, there's the matter of lead time to consider. By the time we make a chart for your route, changes may obsolete the chart."

He countered, "I see that all right, and I'm not asking for the moon. If you eliminate the more infrequent runs and combine the others, you can plan these strips to cover major airfields and cities and reduce the number quite a bit. Once you get the number of routes down to a reasonable amount, the rest is simple. The coverage is there; it's just a matter of printing the charts."

I took a deep breath for the next exchange. "There are other problems. Certainly, as you say, eliminate the less frequent runs and combine others. That's a must. But now what do we have? Let's say you want to go from Point *A* to Point *B*. Chances are, if we reduce the number of strips to a reasonable amount, these points will not be centered on the strip. Possibly one or both may not appear at all. But if we assume they are both off-center, you may very well run out of working space for radio or celestial navigation. Also, you may want to change course because of weather, to take advantage of favorable winds or to evade interception. You may get off course before your next fix shows a wind shift. Restricted strip chart coverage would be inadequate in these kinds of cases.

"As for production, it looks like a simple matter, but it isn't. For instance, we have four charts of a standard coordinated series. Let's say charts *A* and *B* are adjacent to one another in one latitude band, and *C* and *D* are directly below. However, *A* and *B* are constructed on a different set of standard parallels from *D* and *C*. This situation occurs at various latitude bands to distribute scale error inherent in


INFORMATION CURRENT AS OF ?
INFORMATION CURRENT AS OF JUNE 1951
INFORMATION CURRENT AS OF APRIL 1950
INFORMATION CURRENT AS OF NOVEMBER 1953
INFORMATION CURRENT AS OF AUGUST 1955

New and revised information flows in continually. Strip charts must be reprinted often.

the Lambert Conformal projection. The result is an imperfect fit of charts constructed on different sets of standard parallels. I won't go into the technical details; it's one of the things we run into by flattening a sphere. Something's got to give. To produce a strip chart running diagonally across all four charts, we are faced with adjusting the fit prior to printing.

"Suppose that we have now produced such a strip. New information becomes available which causes chart *A* to be recompiled and reprinted. What should we do about the strip? This new information was either of major importance or an accumulation of minor changes that are equally serious, otherwise we wouldn't have to revise the chart.

"If we revise the strip, charts *B*, *C* or *D* may soon require revision. New and revised information flows in continually. This means that a strip chart must be reprinted as often as each component chart, or else be used despite its present incorrect condition. No easy choice, is it?

"There are storage and distribution problems, as well. There's extra storage at the production end, and it's at a premium now. There's extra shipping and record keeping. And you'd have storage problems at the operational end as well, where it's even more critical.

"Now for the other side of the picture. Only so much money, manpower and production facilities are available. When the choice boils down to programming for required charts and target materials, the logical course is crystal clear."

The Major, tapped his cigarette against the ash tray. "I didn't realize all of this. I know the problems we have in using charts. I'm amazed at what you are up against in making them. Looks like I'm shot down."

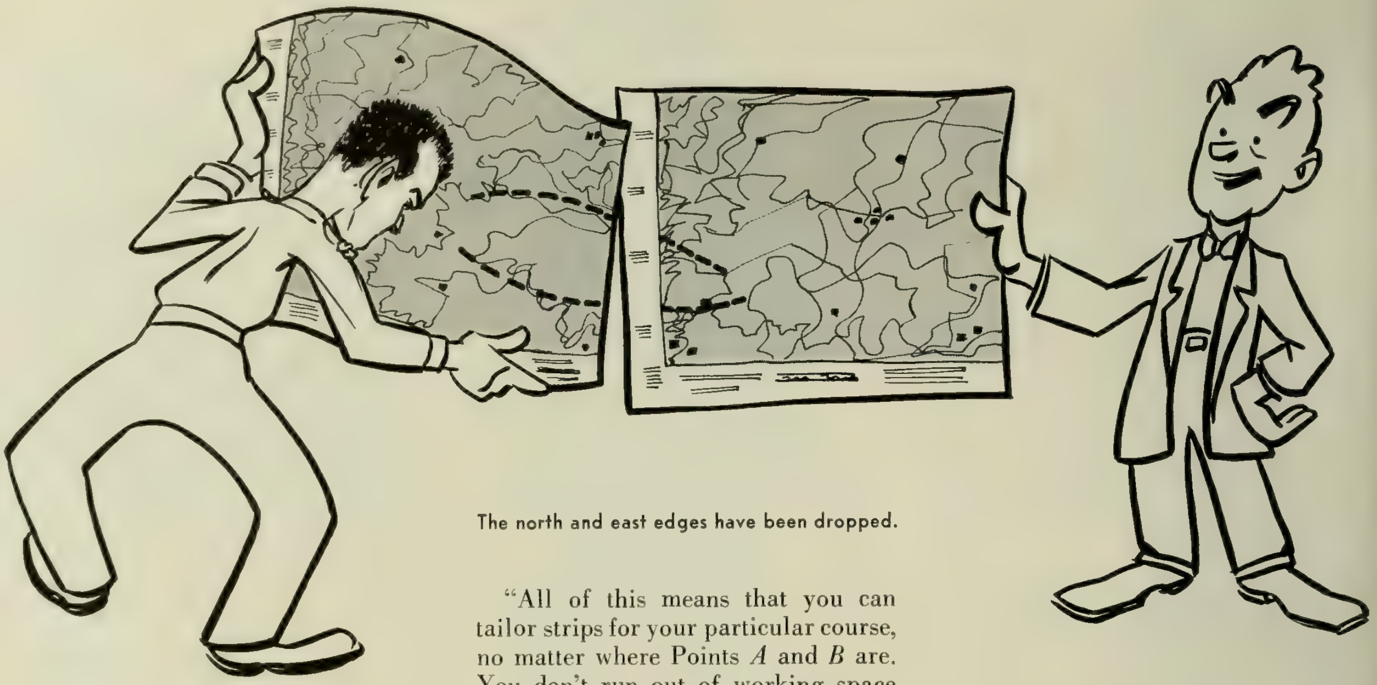
From the disappointed tone of his voice, I could tell that it just didn't seem right to him that nothing could be done. "We've been thinking about this problem for some time," I said. "It has been brought up many times before. More than that, we've already done something about it and may be able to do even more. Everything I said still goes, but we've taken a new approach to the problem and have asked ourselves this question: 'If we can't do it for them, what's the next best thing?' The answer we came up with was to make it as easy as possible for the chart user to do it himself.

"We've developed what we call a 'partial margin' format for our coordinated series of charts. Instead of having a margin all around the chart, in the usual manner, we've dropped the margin from the north and east edges; chart detail goes right out to these edges. We then relocated marginal data in the remaining two margins. You can now join charts much easier by simply placing one chart over the margin of the adjacent chart without folding or trimming the edges. This helps in particular on the north edge, which is a curved line on the Lambert Conformal projection. We've compiled overlap detail from the south edge of the adjacent chart into this 'bow-shaped' area, and as far as joining is concerned, eliminated the resultant curve.

"On the new Jet Navigation Chart Series (JN), Scale 1:2,000,000, which will have world coverage, this format has already been used. Practically all of the northern hemisphere is produced in this series, and we'll be printing southern hemisphere sheets before very long.

"Domestic charts are produced by the U. S. Coast and Geodetic Survey and do not have this feature now, but later editions will be converted. Our new and reprinted 1:1,000,000 scale

The problem. Charts A and B are constructed on a different set of parallels from C and D.



The north and east edges have been dropped.

World Aeronautical Charts (WAC), 1:500,000 scale Pilotage Charts (PC), and 1:250,000 scale Approach Charts (AC) are being printed with partial margins. Other series will also be converted if we determine that this feature is required.

"Another angle to solving this problem is to improve chart-matching characteristics. We have increased the spacing of standard parallels on the JN Series and, as a result, decreased the number of latitude bands where an imperfect fit will occur.

"The dimensions of the JN chart have been increased to about twice the size of a standard WAC, PC or AC. Printed copy is placed so that strips cut in any direction will retain necessary detail. Examples are the closer spacing of isogonic line values and the placement of graticule values along each full degree within the body of the chart. These features result in greater convenience to the pilot making strip charts.

"We're also working on the development of an adhesive that can be coated on the underside of the north and east edges so tape won't be necessary. This presents some problems. We don't want the charts to stick together in packages because of heat, pressure or humidity; we don't want the stuff to 'set' too fast for proper matching, and we don't want it to be uneconomical. But these are our problems and we hope to overcome them.

"All of this means that you can tailor strips for your particular course, no matter where Points *A* and *B* are. You don't run out of working space and you don't have gaps. Another thing, you know what good results we've had from pressure pattern and jet stream flying. Other techniques are also under development to reduce flight time by going the long way. Well, you need a wider strip if your track snakes through the sky, and this new approach gives you the flexibility that you've always needed."

All signs of disturbance seemed to have left the Major by now. "Well, I can see you have some good points in your favor—sounds like you're on the right track. Your approach reduces the workload for both of us and gives me exactly the strip coverage I need. Now, if I followed you correctly, we can take a JN Chart and simply fold or cut away the unwanted area and for many flights we only need one chart. It sounds real good! But one last question. How about all the scraps of paper on the floor? You've talked about saving money. Doesn't that waste money?"

The Major was certainly thorough. "It may seem that way," I replied, "but actually it's a net profit. Most of the cost of a chart is in the first one. Research, compilation, drafting, photography and plate making comprise the bulk of the total cost. In the quantities we normally have to print the unit cost per chart is quite low. When a chart such as the JN with the strip feature is printed, we run extra copies. The cost of these extra charts is based on press time and paper. We've estimated the cost to be about 15 cents per chart. A B-47 can burn that much worth of fuel in about one second of flight.

"However, there may be cases that justify strip chart production. We know that some routes are heavily traveled and quite stable. In these cases we can center terminals on a strip. If most of the coverage is over water, only terminal portions of the chart would be subject to revision. We have produced some of these charts and will look into situations where it appears logical to produce others. Possibly we have failed to discover all such conditions in the past, or our priority workload just won't let us get to the problem immediately. But we work closely with the operational people and try to keep pace with their problems."

We were both relaxed again. Reflecting on the discussion, I thought, "It's good to talk over these matters. It makes for better understanding."

"You know," said the Major, "I was just thinking. A lot of pilots gripe about preparing their own strip charts. I think they'd look at it differently if they'd heard what you have said tonight. If you could only reach more chart users!"

I laughed. But then I got to thinking about his statement. ●

WELL DONE

TRAINING ★ TEAMWORK

1ST LT. WILLIAM K. HARDY was on duty as senior mobile controller at Bryan Air Force Base, Texas. Heavy jet traffic was in progress.

2d Lt. Robert J. Morrow (then aviation cadet) entered raffic at the end of the flying period. On his pitch out or landing, a large bird struck the windscreen of the T-33. The impact shattered the windscreen and carried the bird and glass into the cockpit. Lt. Morrow was partially blinded.

Turning on downwind, Lt. Morrow lost approximately 000 feet of altitude. He called "Mayday" and informed mobile control of his predicament. Lt. Hardy immediately ordered all other aircraft out of the pattern and cleared Lt. Morrow to land.

He approximated Lt. Morrow's altitude at 400 feet and asked him how well he could see. The pilot replied, "Just a little, but I can't see how high I am."

Lt. Hardy began giving Lt. Morrow continuous instructions, turning him on base and final. He lined him up with the runway, guided him through a normal approach and intentionally landed him a little long. After touchdown, Lt. Morrow's vision returned sufficiently for him to maintain directional control and bring the airplane to a afe stop.

An accident was averted because Lt. Hardy was quick o grasp the situation and able to give clear, positive landing instructions to Lt. Morrow, who calmly followed these nstructions.

The performance of Lt. Hardy and Lt. Morrow is an xample of the value of close cooperation between the mobile controller and the pilot. Well done!

1st LIEUTENANT

William K. Hardy

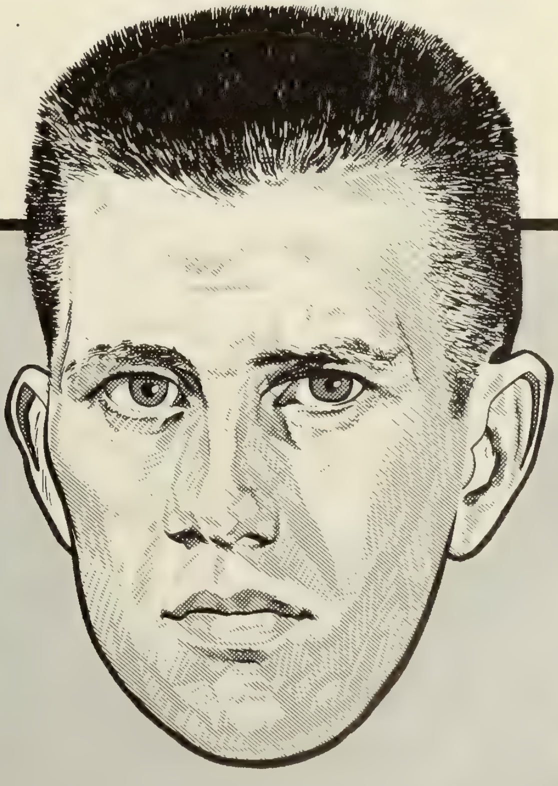
3531st PT Sq, Bryan AFB, Tex.

★

2nd LIEUTENANT

Robert J. Morrow

62d FIS, O'Hare Intl Arpt, Chicago, Ill.



Keep Current

NEWS AND VIEWS

Faster and more economical. One of these YC-97J Stratofreighters, powered by T-34 turboprop engines, flew the Atlantic in six hours.

New Flying Saucers?—Tiny meteorological research balloons launched from Air Force planes are scheduled for release during the coming months over different sections of Texas. Purpose of the test balloons is to study atmospheric turbulence and wind circulation over mountain and ocean areas. The balloons are approximately six feet in diameter and will appear in the sky as small luminous spots after they are launched.

The whole program is connected with hurricane research. When a balloon is released from an aircraft in flight, it drops as a package for a short distance, before automatic inflation. A small, plastic, gas-filled bottle inflates the balloon which then drops to earth by a small parachute, ten feet in diameter.

The balloons have no instrumented packages, but each carries a postcard, requesting the finder to fill in certain information as to where and when it was found and to mail it back to the launching scene.

Twenty-nine years apart. Replica of "Spirit of St. Louis" and C-124.

Automatic Traffic Control—An electronic computer for use at the Air Route Traffic Control Center at Indianapolis is one of the first steps toward an automatic air traffic control. The equipment will be ready for installation in September, 1956, and is to be operated by the Civil Aeronautics Administration.

The IBM equipment relieves the operator of the clerical detail involved in separating traffic in the air, and does the job far more quickly. The principal element of the computer is a memory drum which can store information on all airway routes and bring it up instantly on demand from the controller.

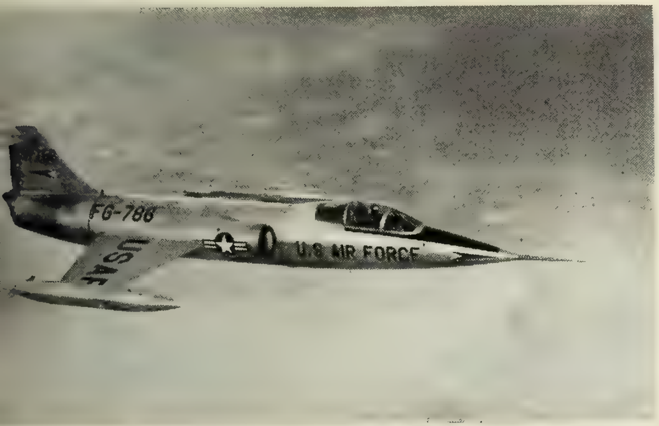
The controller types out the flight plan in punch card form and feeds the card into the computer. The computer searches the drum and comes up with a series of printed strips giving the controller a continuous "program" of the proposed flight. This gives the controller more time to make decisions, uncluttered by the task of remembering a mass of details and of calculating and writing flight progress strips.

★ ★ ★

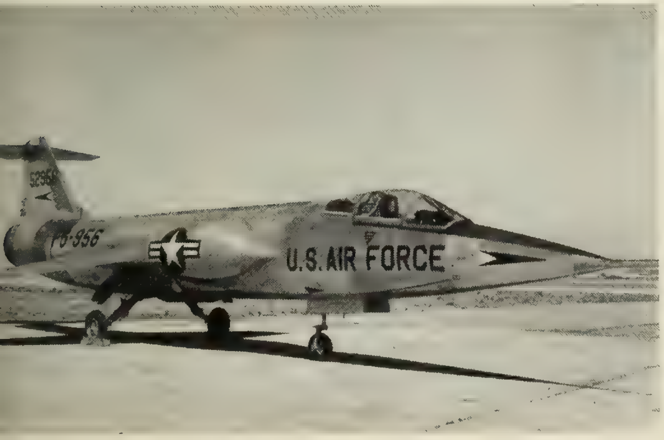
H-mmm-Hmm-Hmm—a new automatic warning device dramatically reminds pilots to lower their wheels when landing.

The device puts a bothersome 250-cycle interrupted tone into the pilot's headset when he prepares to land. The signal functions when the throttle setting, airspeed or altitude of the airplane indicates a landing is coming. It may be stopped manually or will stop automatically when the wheels are down and locked.

The F-104 is the only jet fighter using a downward ejection seat.



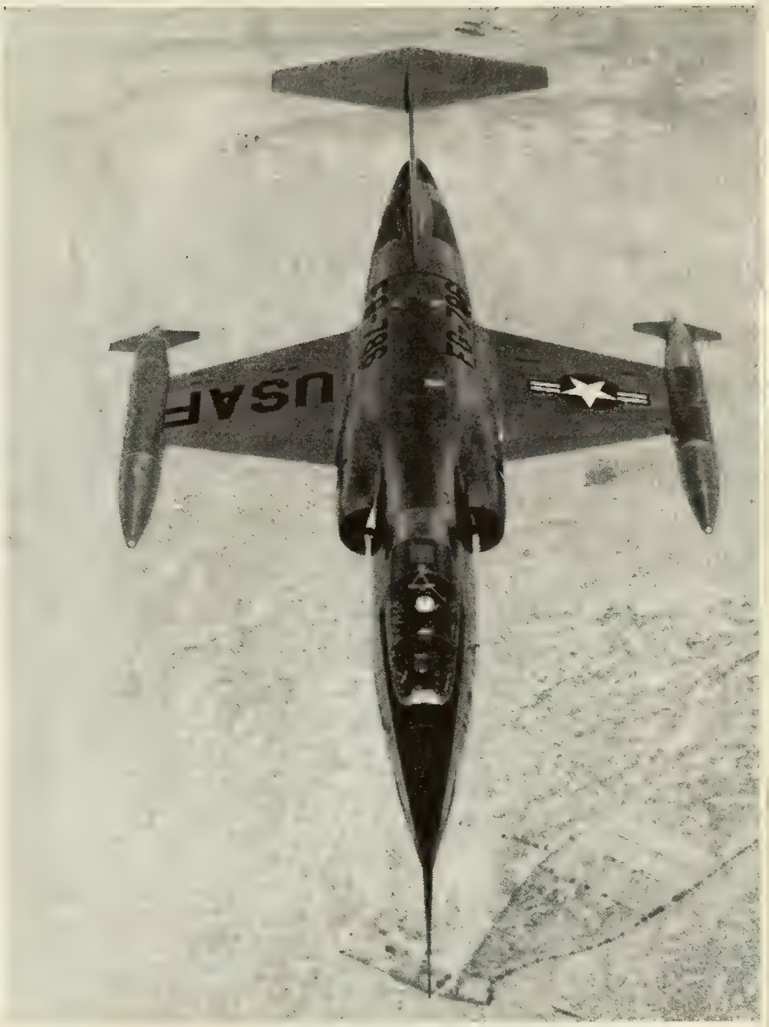
The T-shaped horizontal stabilizer has no elevator and moves as a unit.



Intake ducts are masked in this photo. Top speed remains secret.

Although the device is built into the pilot's radio headset, it operates independently. The warning signal will function even if the radio is disabled. It normally operates from a 28-volt (DC) system, but it can operate on as low as 14 volts if the airplane's electrical system is damaged and only the battery is functioning.

It uses three noise levels. It is hermetically sealed, weighs only 13 ounces and has a total volume of 13 cubic inches.



Sharp-edged wings are thinner than those on rocket research planes.

Newest Fighter—Shown above is the latest in air superiority fighters, the Lockheed F-104. Dubbed the "Starfighter" it has the greatest combination of speed and flying performance ever built into a combat aircraft. It is powered by the new General Electric J-79 turbojet, constructed especially for the 104.

Producing more thrust per engine weight than any other aircraft, the 104 is acclaimed as the "world's fastest fighter." Its top speed remains a secret.

The unusual wings are less than 22 feet long overall, and are thinner than those on rocket research planes. The leading and trailing edges are so sharp that sheaths are fitted on them to protect ground crewmen.

The wing down-droop is an aerodynamic design engineered to enhance precision control of the high tail. The T-shaped horizontal stabilizer has no elevator and moves as a whole unit.

In addition to its outstanding speed and performance, the 104 is described as a real "pilot's airplane." Tony LaVier, veteran engineering test pilot, says, "The F-104 is completely honest and a pilot's dream to fly." ●

Here is the second installment on flying the F-100. North American Aviation test pilots discuss how to spin and how to roll this airplane. FLYING SAFETY will continue to keep you informed on flying techniques and operational procedures of all the Century series aircraft.

Parade of the

YOU'VE PROBABLY HEARD many wild tales regarding the spin characteristics of the F-100. On all new airplanes, rumors concerning spins seem to spread like wildfire. Most of these are either completely erroneous or so greatly cloaked in fiction as to be worthless. The purpose of this article is to give you the straight, ungarbled word.

The F-100s have been flying now for more than 2½ years and have been in tactical use in Air Force fighter groups for 1½ years, yet I know of only two cases of pilots inadvertently spinning the airplane. One of these spins resulted when a pilot tried to do a loop from above 30,000 feet at 300 KIAS in military power (no afterburner). He didn't get over the top, and in trying to recover from a nose-high, on-his-back attitude while fresh out of airspeed, caused the airplane to yaw around (probably by unjudicious use of ailerons) through three quarters of a turn inverted where it came over right side up in a normal rotational spin.

The only other inadvertent spin of which I know occurred from a high-altitude accelerated stall, and I shall go into details on that later in this article. The points I'm trying to get over here are that (1) there is little chance of your inadvertently spinning the airplane, particularly if you read and heed this article, and (2) if you do spin the airplane and follow the correct recovery procedure, you are going to recover from the spin.

Spin Recovery

Here is the one and only spin recovery for the F-100A and F-100C. *Hold ailerons full with the spin, stick full back and rudder against the spin until rotation stops.* The airplane will then be in a stalled attitude. Recovery from this stall can then be made with normal stall recovery procedures—if the nose is extremely high, *pop* stick forward with rudder and ailerons as needed to hold wings level, or if the nose is low, *ease* stick forward with rudder and aileron deflection as needed to hold wings level.

With this procedure, recovery is effected from most spins in one-quarter to one-half turn in the F-100A, and in one to 2½ turns in the F-100C. Aggravated or violent spins may require up to four or five turns of constant recovery controls to bring about recovery. It is believed that even a completely flat spin would recover in eight turns or less with this recommended recovery method.

Experience has shown that it is of

F-100 Centuries

Spin Tests

J. O. Roberts, Engineering Test Pilot

no value to return to pro-spin controls and then go back to recovery controls. Once you recognize that you are in a spin and know which direction you are spinning, *apply full aft stick, full opposite rudder, and full aileron in the direction you are spinning* and hold these control deflections continuously until rotation stops or until you are 10,000 feet above the terrain, where you should eject.

If, because of some airplane malfunction or damage, recovery is not affected as described in this article, continue holding recovery controls and try pulling the drag chute handle. If the drag chute will come out (air loads are such that in a completely flat spin it probably will not come out), it may aid recovery. However, be prepared to jettison it once recovery is accomplished.

Spin Characteristics

We performed successfully more than 115 spins in F-100 type airplanes. They included spins in the clean airplane with landing gear down, with speed brake down, and with drop tanks and bomb pylons installed. Spin tests were conducted at medium and high altitude.

Because of adverse yaw, the F-100 will not enter a spin in the direction that the ailerons are deflected. Any time I tried to spin the airplane with the ailerons deflected in the direction of the intended spin, it started off in the opposite direction. However, on one occasion when a particularly violent spin was obtained in an F-100C, it was determined that with full forward stick, moving the ailerons over in the direction of the spin would not cause the spin to stop or even slow down. It was this spin, by the way, which finally proved that full aft stick was better for recovery than full forward stick.

With the ailerons held exactly at neutral, the airplane will not enter a true spin. With stick full back and full rudder in the intended spin direction, *but with neutral ailerons*, the nose pitches up and over slightly and then drops through to a 60 to 70 degree, nose-down position with very slow rotation rate. The airplane maintains this attitude while yawing slowly in the direction of the deflected rudder. Any time back pressure on the stick is released, the airplane flies right out.

If moderate amounts of opposite ailerons are added, the airplane yaws up to an attitude of approximately 20 to 30 degrees nose low and half-heartedly spins with the nose oscillating between this attitude and the 60 degree nose-down attitude. Any time neutral aileron is resumed, the nose falls back to 60 to 70 degrees below the horizon.

The only F-100 spins that I would call truly well-developed spins are those where full aileron or almost full aileron is held against the spin. The characteristics of this spin vary slightly from airplane to airplane and depend upon whether the spin is left or right. However, in general, these are the spin characteristics.

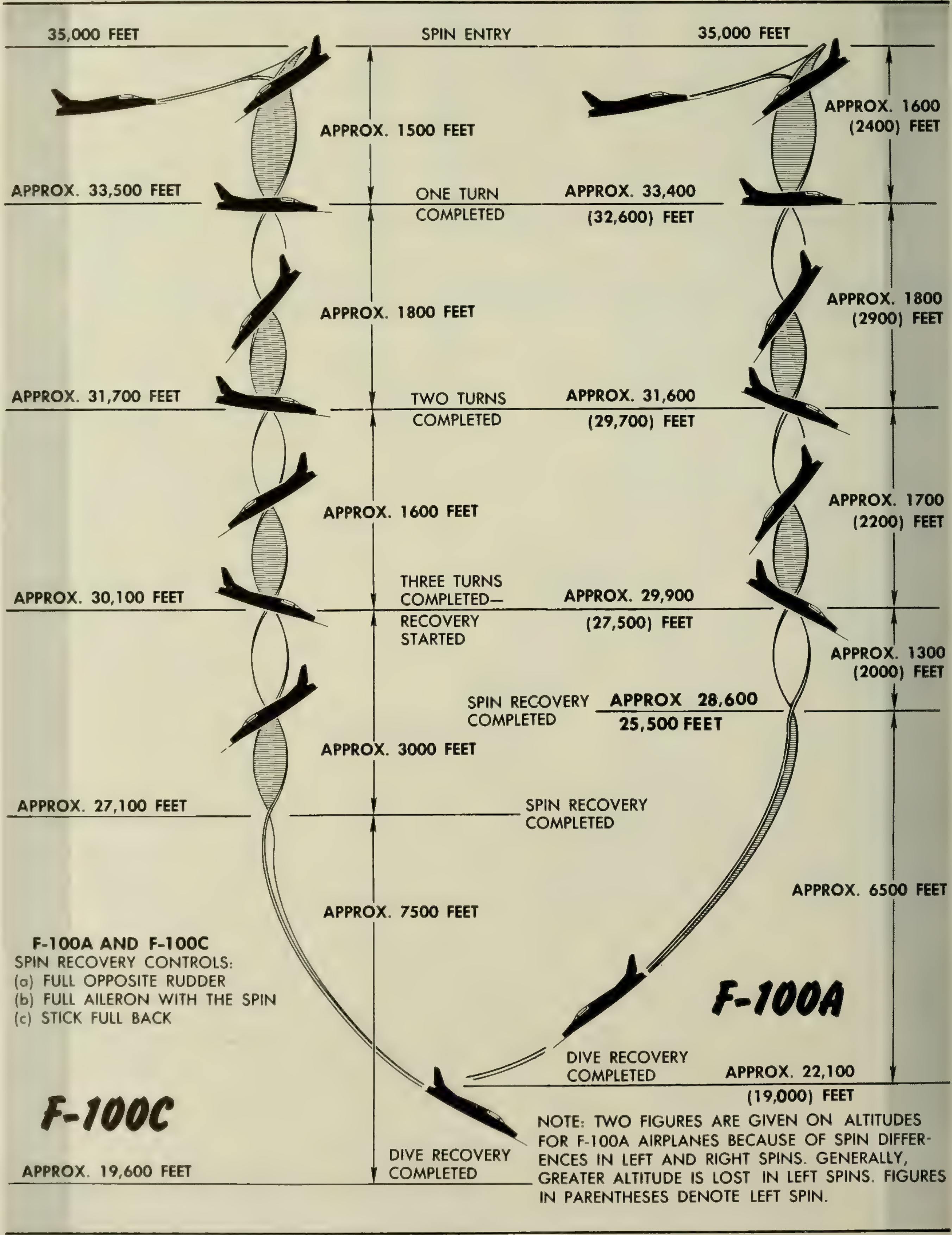
Yaw Builds up Rapidly

The nose pitches up and over in the direction of the intended spin and then drops to 50 or 60 degrees below the horizon at the end of one half turn. Yaw then builds up rapidly as does rotation rate, and the nose swings back up until it is at least level with the horizon at the end of one turn. On the higher altitude spins, the nose definitely is 10 to 20 degrees above the horizon at this point, and the pilot has the impression that the spin may be going flat.

In the F-100C, the nose then swings back down to an attitude of approximately 30 to 40 degrees below the horizon at the end of 1½ turns and again starts to swing back up again. At the end of two turns, the nose is slightly below the horizon; at 2½ turns, it is 20 degrees down; and from then on, it is pretty stable at about 20 degrees nose low. Rotation rate has built up by this time, so that the airplane completes the third turn at a rate of one turn in four seconds.

Rate of descent after the spin has stabilized is between 1500 and 2000

The F-100C should recover by 2½ turns.



F-100A AND F-100C
SPIN RECOVERY CONTROLS:
(a) FULL OPPOSITE RUDDER
(b) FULL AILERON WITH THE SPIN
(c) STICK FULL BACK

NOTE: TWO FIGURES ARE GIVEN ON ALTITUDES FOR F-100A AIRPLANES BECAUSE OF SPIN DIFFERENCES IN LEFT AND RIGHT SPINS. GENERALLY, GREATER ALTITUDE IS LOST IN LEFT SPINS. FIGURES IN PARENTHESES DENOTE LEFT SPIN.

With external tanks installed, pilots should use the normal spin recovery procedures.

feet per turn in the F-100C, between 1600 and 3000 feet per turn in the F-100A. The F-100A and C airplanes lose about the same altitude in the first turn, since the spin is not well developed until the latter part of this turn. Once the airplanes are spinning good, the F-100A loses more altitude in each successive turn because it spins more nose down than the F-100C.

In the F-100A, the spin remains the same in succeeding turns as in the first turn. The F-100A never tends to stabilize, but continues to oscillate with the nose 60 degrees down at least a part of each turn.

From entry altitude to recovery in straight and level flight after a three-turn aileron-against spin usually requires between 14,000 and 16,000 feet. One-turn spins require approximately 10,000 feet. This is why we say that you should eject if a spin is entered below 10,000 feet above the terrain or if recovery is not imminent at 10,000 feet from a spin entered at a higher altitude.

Spins out of 2G turns, spins with landing gear down, spins with speed brake extended, and spins with two 275-gallon external tanks installed demonstrated, with very minor variations, the same characteristics as those described. Spins entered at higher altitudes (45,000 feet and above) appear flatter with the nose coming higher at the end of the first turn. Spins in the F-100C with six bomb pylons showed approximately the same characteristics at 35,000 feet as clean airplane spins at 45,000 feet and above.

It is possible to get the F-100 into a violent spin by either (1) holding full, or almost full, ailerons against spin for several turns and then popping stick forward while still holding ailerons against spin (this may sound like something you would never do, but the forces in the cockpit on the pilot's body are such that unless you specifically think about avoiding it, you will unconsciously hold some ailerons against spin) or (2) stalling the airplane in a high-altitude, high-speed turn which may result in the airplane yawing violently and rolling up over the top. If the pilot opposes this airplane motion, the airplane will spin because of the aft-stick, aileron-against-spin control position.

Flat Spin Entry

Only one flat spin has been encountered in an F-100A airplane. This spin was entered in a manner peculiar to flight testing.

In the past, airplanes have had only enough elevator control available to produce the stall at low speed (a 1G stall). This was the determining factor for the size and throw of the elevator. Since the F-100 is a supersonic, as well as subsonic, airplane, it was necessary to provide a large movable horizontal stabilizer with a large throw in order to be able to reach accelerated stalls or limit load factor (7.33G) at supersonic speeds. (Because of a great increase in airplane stability in the supersonic speed range, greater movement of the stabilizer is required to obtain stall or limit G.)

Thus, on previous airplanes, it was the accepted test procedure for spin entry to decrease the speed at the rate of one knot per second until the stick was full back. This was done in an F-100A by an NAA test pilot, and in this manner, a speed well below normal stall speed was reached.

Usually, it is difficult for the pilot to hold wings level down to this speed, which was 108 knots. At this speed, the F-100A sinks like a rock. But with wings level and stick full back, the pilot simultaneously applied full left aileron and full right rudder. The airplane went into a flat spin in the first one-half turn, and from that point on, nothing the pilot tried altered the attitude of the airplane, which was nose on the horizon.

At the time of this spin, the accepted spin recovery procedure was to reverse rudder with neutral aileron, pop the stick forward, and hold for two turns. This control combination, as well as others, was tried without any success.

I definitely do not believe there is any way of getting the airplane into a flat spin other than the method herein described. Therefore, it is quite simple to stay out of a flat spin —don't do this. I also believe that holding the now accepted normal recovery procedure for seven or eight turns is the best possible way to recover from a flat spin.

Avoiding Spins

There are a couple of basic flying rules that I'd like to pass on to you on the subject of avoiding spins in the F-100:

- First, should you find yourself at the top of some acrobatic maneuver, plumb out of airspeed, and fresh out of ideas, don't *ever* try to force the airplane, through random control motions or cross controlling, back to a right-side-up straight-and-level attitude. Make no violent or large control movements; just hold more or less what you have and let her fall through a little sky (you shouldn't embarrass yourself by getting into these positions

★

J. O. Roberts flew P-40s in the Aleutians in 1943, and during his nine years with the Air Force has flown P-47s, P-51s, P-80s and F-86s. While flying the F-86 in Korea he was credited with downing one MIG-15 and credited with damaging another.

He attended Yale for two years, and graduated from the Air Force Test Pilot's School at Edwards AFB, Calif. He has been an engineering test pilot for North American since March 1952. He flew in the test programs of the T-28B, F-86D, H; F-100A and C.

at low altitude) until it is flying again. *Then* fly it back to where you want it.

- Second, and this is closely related to the first, remember that whenever an airplane stalls, its control surfaces don't have normal effectiveness. Therefore, as they taught you in primary, make a stall recovery first; then fly it with the controls. Here I am referring particularly to high-speed, high-altitude accelerated stalls. The F-100 will yaw and roll up over the top, but it is stalled, whether you think you did it or not, so don't oppose these airplane motions with the controls. Use normal stall recovery of going with the maneuver, going forward on the stick. Only after you have it flying again should you resume what you were doing.

In this manner, you should be able to avoid spinning so that you don't have to use that accepted recovery procedure of:

- Full aft stick
- Full opposite rudder
- Full aileron with the spin. ●

Rolling the "100"

Herbert "Zeke" Hopkins, Engineering Test Pilot

As MOST OF you probably know, the Air Force has a specification for the flying qualities of the airplanes it purchases. This specification covers everything from soup to nuts, and that's a lot with airplanes like the F-100. The F-100 was built to comply with military specification 1815B, published in 1948 when certain of the characteristics encountered in the F-100 weren't even gleams in the designer's eye.

This article is intended to cover the roll characteristics of the F-100 where differences from past airplanes have been encountered.

There are a number of ways to cause an airplane to roll. You can lean, use engine torque, ailerons, spoilers, flaperons, rudder or various combinations. In high-speed flight, the conventional outboard-mounted aileron, when deflected, causes the wing to twist to such an extent that in extreme conditions the airplane will actually roll in the opposite direction. To try and eliminate this problem, our designers chose conventional ailerons set at mid-span for the F-100. The control surface is in two parts so that wing twist will not apply excessive twisting forces to the aileron. With the ailerons placed at mid-span, no aileron reversal is present up to maximum dive speed.

Adverse Yaw

Now, what characteristics result from this two-piece aileron that require watching and understanding? The first is not new—adverse yaw. When the ailerons are deflected on most airplanes, the "down" aileron (upgoing wing) has more drag on it than the "up" aileron, causing the airplane to yaw in the direction opposite to the roll; hence "adverse" yaw. In the F-100, with ailerons powerful enough to give a satisfactory rolling rate at maximum dive speed, it stands to reason that at lower speeds roll rate will be quite high, and at certain speeds this means a high value of adverse yaw. Without going into too much technical detail, the adverse yaw tendency is greatest subsonically at high altitude. Incidentally, adverse yaw will not show on the turn-and-slip indicator because the ball is above the airplane roll axis, and inertia will move the ball in the direction opposite the way you move the stick, erroneously showing favorable yaw.

At speeds above approximately .9 Mach, because of changing aerodynamic effects, the yaw due to aileron deflection actually reverses and becomes "favorable" yaw, reaching a maximum at approximately 1.2 Mach number. At this Mach number, if you jam the stick hard over and hold it, the rate of roll will continue to increase, as will the yaw angle. Eventually, you could exceed the structural limits of the airplane. It takes more than one full 360-degree roll for this to happen, how much more depends on other factors, so the F-100 is limited to full aileron of sufficient duration to produce one complete revolution. This may mean returning the aileron to neutral as early as 270 degrees of roll. As a matter of interest, rate of roll is higher in right rolls than in left rolls because of engine torque effects.

High Roll Rate

This brings us to the second characteristic—high roll rate. If you slap the stick over to one side at .8 Mach number, it won't take you more than a few hundredths of a second to know that you've really got a tiger by the tail. In another fraction of a second, you're rolling so fast you begin to lose orientation. Because of yaw and pitch rates, you're getting some uncomfortable knocking about in the seat, and if you're human, you'll slack off on the stick. A good criteria is: Do not roll any faster than is comfortable and you'll never get into any trouble. The airplane needs all of that deflection at extreme speeds—the pilot can use a lot less than full deflection very nicely at most normal speeds. The maximum roll rate of 220 degrees per second is quite a bit higher than most pilots can comfortably tolerate.

Probably the most serious problem connected with rolling is a characteristic called inertial coupling. If you'll excuse a little technical poop, the coupling terms in the equations of airplane motion have heretofore been small numbers which, when multiplied together, had such a negligible effect on the result, they were neglected. Normally, they're referred to as second-order terms. They were neglected once too often and some pretty violent snap rolls occurred, so now nobody neglects them no mo'! Physically, it's a little difficult to draw an analogy. If you're flying along level at a certain angle of attack and instantaneously roll 90 degrees, then angle of attack becomes an angle of yaw. Throw in more yaw, due to aileron deflection, and a little from other sources, and the airplane has not only a roll rate but also a yaw rate.

Make another instantaneous 90-degree roll to inverted, and this deflection from the flight path turns into a negative angle of attack, so now we have a pitch rate. There's an awful lot of weight concentrated along the fuselage of all modern fighter airplanes. This means high inertia. Once all of these rates start building up, the airplane begins to gyrate about all three axes, and the inertia about each airplane axis begins to affect motion about the other two, hence you have inertial coupling.

One analogy that might help is that of the dumb-bell. If you suspend a normal weight-lifter's dumb-bell from its center of gravity and spin it so that the axis of spin is right down the long axis, through the center of the handle and through the middle of the balls on each end, it will spin properly. But just touch one end, to start a slight motion in another direction and the inertia of the spinning balls will affect this motion. In very short order, the dumb-bell will be gyrating wildly about all three axes, posterior over teakettle. Of course, the airplane isn't nearly this bad, because it has vertical and horizontal stabilizers, but if roll rate is too high, the inertia forces can overcome the stabilizing forces of the tail surfaces. It was for this reason that a bigger vertical tail was put on the airplane. Inertial coupling contributes to the yaw due to roll, so that even when you roll supersonically, where yaw is "favorable" (in the direction of roll), the yaw angles get quite high. Understand now, if you operate according to the Dash One, you're not going to have any trouble. If you exceed the limits, you're on your own.

Know Your Aircraft

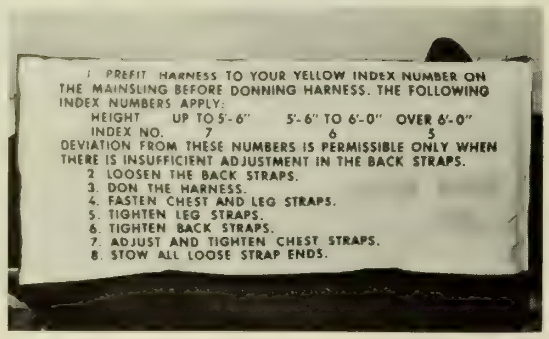
Of course, the reason for this article is to familiarize you with these quirks in the character of the F-100. This is always the best way to get the most out of your aircraft—know all there is to know about it.

Herbert "Zeke" Hopkins is an engineering test pilot currently engaged in the F-100 flight test program. He is a graduate of the U. S. Military Academy and holds a Master's Degree in Aernonautical Engineering from Princeton. Prior to joining North American in 1955, he was flight test engineer at Wright Field for a year and a half and Air Force test pilot at Edwards Air Force Base for four years.

★

With the high performance we deal in today, it's getting to be a bigger and longer job to nail down all the various flying qualities in engineering flight test. Hence, it takes longer for this information to get to you. It's more important than ever that you operate within the published limits because everything within that range has been checked out. Outside the published limits, there may be large areas where information is incomplete. You certainly don't want to panic if you inadvertently wander into some forbidden area. But—you're flying an expensive hunk of machinery, so why not be smart and stay within limits? Large engineering staffs of aircraft companies and the U. S. Air Force's own engineers are in the business of figuring out what you can and can not do. Don't think you can second-guess them.

Back to rolls. Our test pilots feel that a maximum rolling rate in the neighborhood of 180 degrees per second is all you'll ever need, provided that you can get this rate in a hurry. However, indications are that the inertial coupling problem is going to get more serious as we progress to higher model numbers, so some sort of roll limiter looks like a future black box. This gadget would operate to slack off on the ailerons for you, and would enable you to get the most out of any maneuver at any speed with safety. These gismos have been known to fail, however, so we're back to "know your airplane" as the surest way to effectiveness in the air. ●



1 PREFIT HARNESS TO YOUR YELLOW INDEX NUMBER ON THE MAINSLING BEFORE DONNING HARNESS. THE FOLLOWING INDEX NUMBERS APPLY:

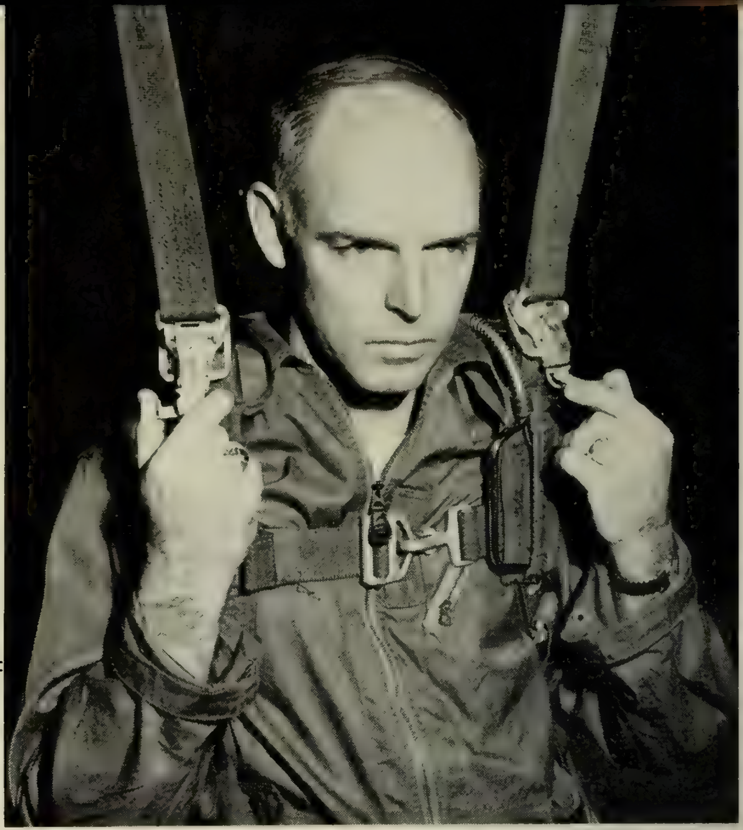
HEIGHT	UP TO 5'-6"	5'-6" TO 6'-0"	OVER 6'-0"
INDEX NO.	7	6	5

DEVIATION FROM THESE NUMBERS IS PERMISSIBLE ONLY WHEN THERE IS INSUFFICIENT ADJUSTMENT IN THE BACK STRAPS.

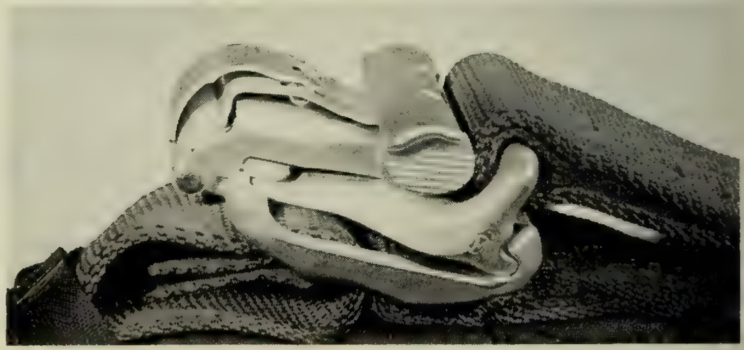
2 LOOSEN THE BACK STRAPS.
3. DON THE HARNESS.
4. FASTEN CHEST AND LEG STRAPS.
5. TIGHTEN LEG STRAPS.
6. TIGHTEN BACK STRAPS.
7. ADJUST AND TIGHTEN CHEST STRAPS.
8. STOW ALL LOOSE STRAP ENDS.

RISER SHARP

Captain Joseph P. Davies, Jr.
Aero Medical Safety Div., D/FSR



Step One. Pilot suspended in harness uses right and left hands to pull out and down on the canopy guard release. Do this when approaching ground or water.



"THE BAILOUT AND descent were uneventful except for greater swinging and oscillation than I expected, but I was dragged for about 200 yards before I could pull the bottom risers in and collapse the canopy." . . . "The ejection and parachute opening were 'no sweat' but I slid across four miles of ice before I could collapse the parachute canopy."

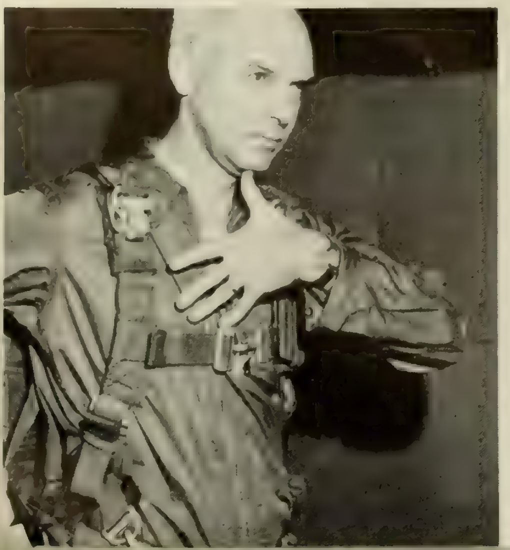
For some time now, the Air Force has been equipped with a Class III parachute harness. This harness is used on all types of chutes—seat, chest and back. It can be adjusted quickly to different sized personnel and a particular advantage is that by operating one or both of the canopy releases, the canopy can be deflated quickly or released completely, after landing. Thus, it is designed to prevent personnel from being dragged through water or across land.

Unfortunately, accident and bailout records show that very few crewmembers know exactly how to use the canopy quick release mechanism. Also, many do not adjust the Class III harness correctly so that the canopy release mechanism can be used easily if necessary.

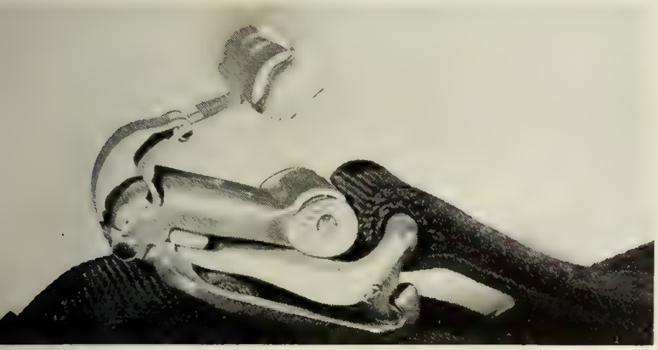
The canopy release mechanism should be located just below the collar bone. You find it by placing your predetermined Index Number on the vertical harness straps.

Even when wearing bulky clothing, the Index Number will ordinarily remain the same. Many crewmembers have been loosening the vertical chest harness straps to accommodate increase in bulk. This adjustment should be made by loosening the diagonal back straps. Otherwise, the canopy quick release mechanism moves up toward the top of the shoulder. Unless a man is a real Goliath an Index Number below five should not be used.

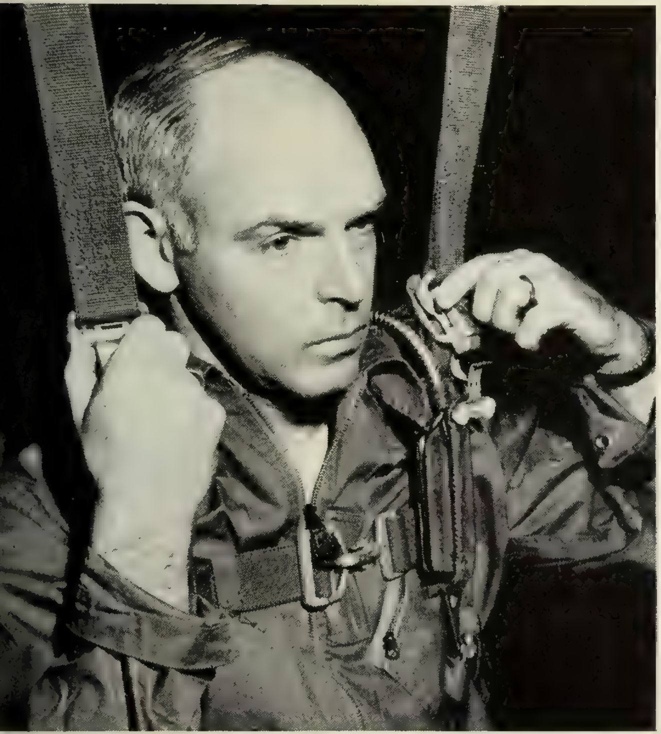
Now as to operation of the canopy release mechanisms. A recent operational survey by personnel of the Directorate of Flight Safety Research,

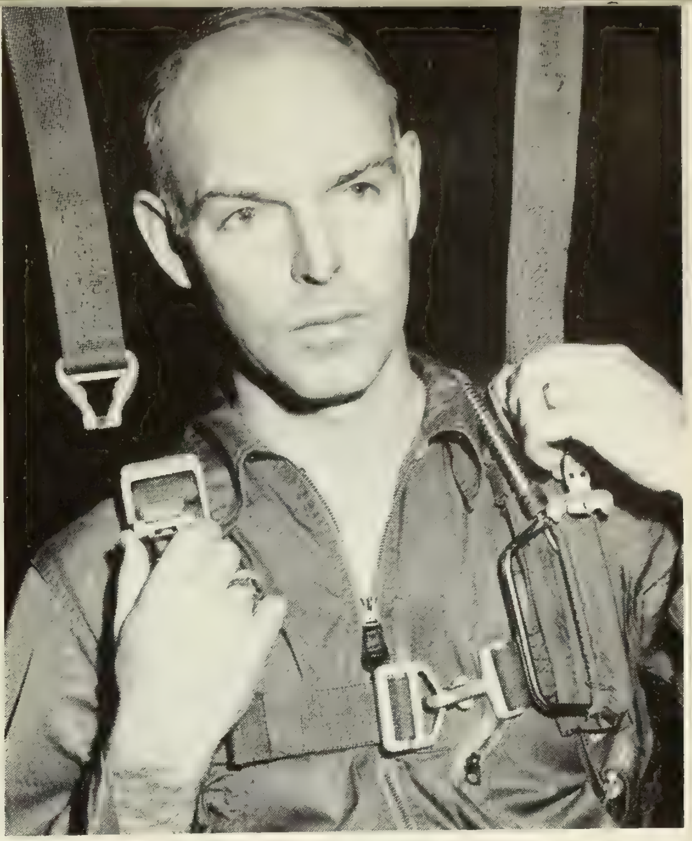


Canopy release just below collarbone. Chest strap approximately 12 inches below chin. Note right hand tightening right back strap.

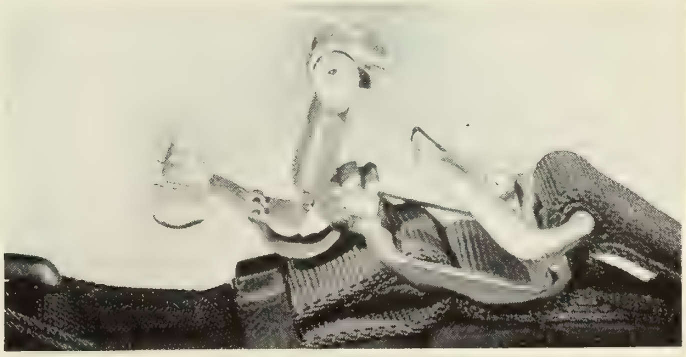


Step Two. When contact with the ground or water is made, the buttons should be squeezed and clip rotated out and down.





Step Three. The right hand riser is free. Canopy will collapse. Try these three steps. Convince yourself that you know how.



proved that a great percentage of crewmembers who were suspended in a Class III harness did not know exactly how to unfasten the canopy release. Further, they were afraid to remove the release guard while suspended in air.

The time consumed by most of these crewmembers in getting this guard unfastened and then actuating the release, would result in being dragged a considerable distance under high wind conditions. Many who experienced difficulty thought that after removing the release guard, the canopy risers would be released merely by squeezing the two buttons on the release. This is not true. Actually, one or both release guards should be removed by pulling out and rotating the guard down as the ground or water is approached. Then with the right hand on the right release and/or the left hand on the left release, as soon as contact with ground or water is made, the buttons should be squeezed and the mechanism rotated out and downward. Releasing one side of the canopy is sufficient to spill all the air.

Survival equipment is attached to the Class III harness. Consequently the harness should be retained during water parachute landings.

Properly used, the canopy quick release mechanism offers real advantages. Certainly, there is no excuse for crewmembers being dragged any appreciable distance by their parachutes, if they are physically able to actuate the quick release.

Your organization can profit by emphasizing a proper fit and adjustment of the Class III harness, and by suspending a Class III harness and having each crewmember sit in the harness and operate the canopy quick release mechanism while his full weight is being applied on the harness. Try this at your next flying safety meeting. "Take the wind out of those sails." ●

the Professional Approach

Lt. Col. Robert S. Walker, Jr., Commander, 84th AR Sq.

TO FACE EACH flight with the confident knowledge that we will not unnecessarily jeopardize our lives or our equipment should be the goal of all of us who fly. Yet, accidents do happen and it has been established that relatively few of them are the result of Divine Providence. Somewhere along the path from the hangar to the scene of the accident, human frailty manifests itself. Indifferent inspection, hasty planning, faulty knowledge, inadequate supervision, unsound judgment and poor technique are but a few of the many terms used to describe human shortcomings sifted out by accident investigating boards.

It is the pilot in command of the aircraft who is entrusted with the bulk of the responsibility for safe flight, for he is there, on the scene, throughout the flight. Yet, he is limited by the framework within which he must operate—his own inadequacies, those of his crew, his supervisors, the quality of maintenance and the many support functions. So we are all involved, and we must ask ourselves how we can help to close this gap of human deficiency, how we can reduce the toll of unnecessary accidents. It is the theme of this article to suggest that a truly professional approach to flying safety may help every pilot to achieve this goal.

First of all, what is meant by a professional approach? We are all familiar with the term "the profession of arms." We can name other professions such as medicine, law, theology and teaching.

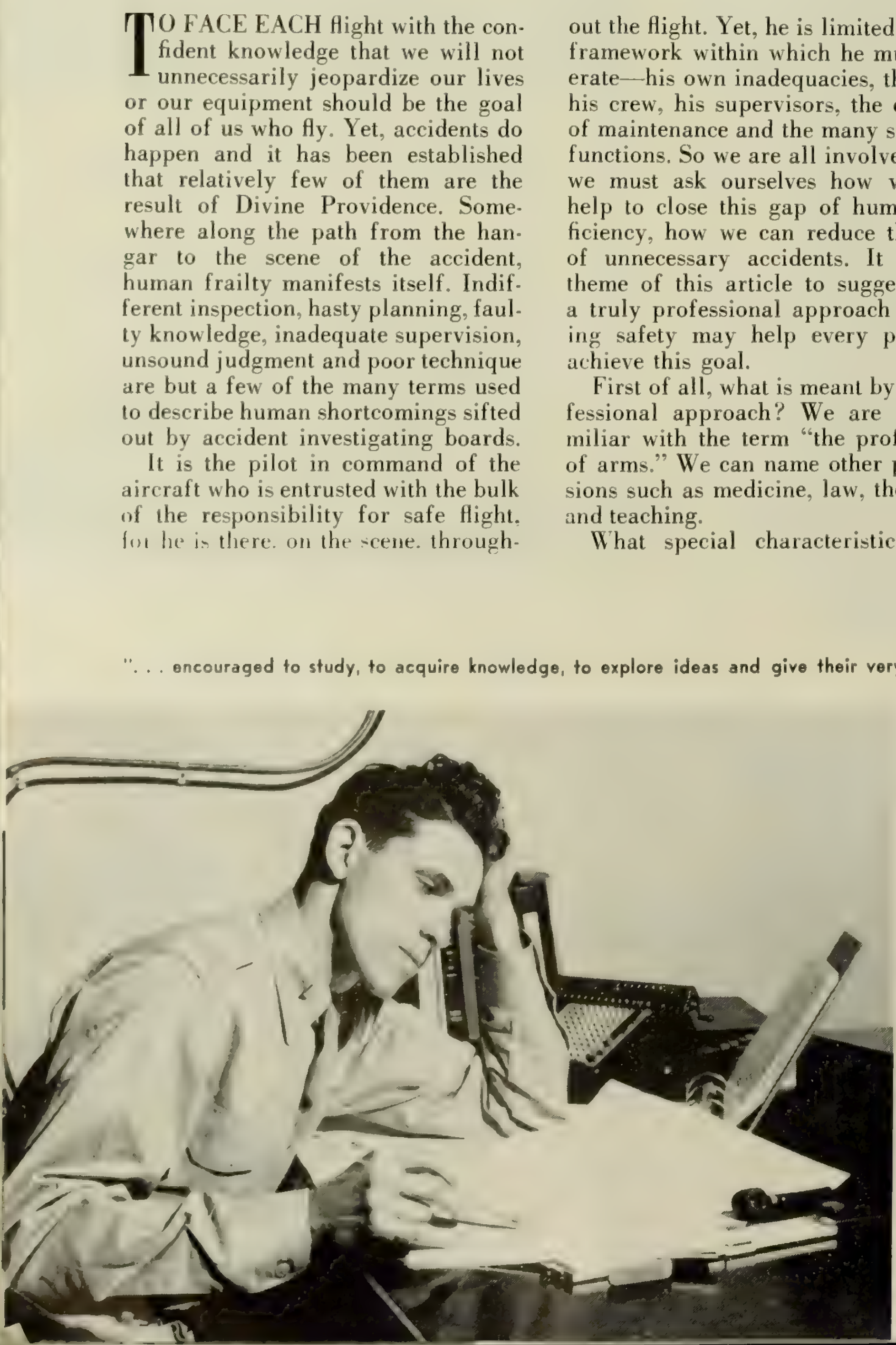
What special characteristics render a profession different from other forms of employment? Essentially, a profession is more than just a means of satisfying our material needs. Its focal point is public service. It signifies a body of people dedicated to the intrinsic value of their works as a contribution to the general welfare. It is characterized by a rigid, well-defined and morally elevated code of conduct. Its members are expected to subordinate their desire for personal gain and self-gratification. They are encouraged to study, to acquire knowledge, to explore ideas, to conduct research, to seek and accept responsibility, to become effective leaders within their community and society and above all, to give their very best to the work now at hand.

A professional approach to an objective then would mean the adoption and application of the attitudes and values suggested above. Moreover, the non-career officer or airman will recognize that these attitudes and values are pertinent and worthwhile in other walks of everyday life as well as to the military profession.

How would a professional approach to our duties stimulate flying safety? Perhaps some specific illustrations would prove the point. The truly professional man regards study and the acquisition of knowledge as a never-ending process, never really fulfilled to his satisfaction. He cannot be content with an eight-hour workday without also losing ground in this respect. Therefore he accepts as the normal course of his responsibility the obligation of study, research and investigation in his field.

Most of us would admit readily that

". . . encouraged to study, to acquire knowledge, to explore ideas and give their very best."



Do you know the background and capabilities of fellow pilots? Will they follow you without hesitation? These are part of the code of ethics which govern our profession of flying.

there is a tremendous body of information that we lack concerning our equipment, the medium through which we fly, the procedures that control our flights, the background and capabilities of fellow crewmembers and the psychology of leadership, to list only a few broad categories. When one considers the already heavy workload for the eight-hour workday, it is dishonest to think that we can make real gains in these areas without consistently applying extra effort "on our own time."

Accident records frequently credit the absence of some vital knowledge concerning equipment or procedures as the principal cause of an accident. Moreover a critical determinant of sound judgment is the adequacy of the information establishing and reinforcing our decisions.

As another illustration, let's examine the code of ethics which governs our profession and apply it to flying safety. Loyalty, dependability and integrity constitute some of the important components of this code. Is the pilot being loyal to his office of public trust and to the men who must fly with him when he jeopardizes both by wilfully violating flying regulations? Is the navigator demonstrating his dependability by showing up late for a briefing with a hastily prepared flight plan? How much integrity does the aircraft commander display when he openly initials the PIF without bothering to read its contents? Such acts are not only contrary to our professional code, but they also prejudice discipline and undermine the confidence of superiors and subordinates alike.

There have been many aircraft accidents which trace their origin to the causes suggested above. Is it possible to relate the professional approach toward personal gain and self-gratification to flying safety? The answer is an emphatic yes.

Consider some of the components of a personality oriented toward these goals rather than away from them. He is likely to be selfish, to seek glory or prestige at the expense of others and to possess an abundance of false pride. Perhaps he even considers himself infallible in his desire to erect a defense against every real or imagined challenge to the wisdom of his final decisions or plans.

Such a man is not likely to be interested in expanding the training or capabilities of his crew. He may take great risks for his own personal convenience without considering those who must fly with him. He might be inclined to discourage advice or suggestions from subordinates, thereby increasing the margin for error and an accident. The professional approach toward flying safety can not accommodate this individual.

In the preceding paragraphs we have tried to present the significance of a truly professional approach toward our responsibilities in the interest of flying safety. It is a human trait that all of us like to believe in the worthwhileness of the activities that dominate an important part of our lives. As members of an honorable and exacting profession we can not help but derive a special satisfaction that accrues to each of us as a result of such membership.

Regardless of how we choose to label ourselves, truly professional status is accorded only those who deserve it and it is not deserved unless we continually apply the attitude and values of the professional approach to the responsibilities of our office. In so doing, we can not help but close the gap in human error that is so costly to ourselves and our people. ●

REX SAYS

A FRIEND OF mine who's an FSO at a training base sent me a copy of his flying safety bulletin recently and asked for my comments. I told him that I was forwarding it to Rex for study.

"Many times an aircraft will call over the radio as follows: '33245, Number One.' Number One, where? Accidents have been attributed to confused traffic instruction such as this. *Clarify your position.* The greatest amount of confusion lies between Number One on taxiway and Number One on runway.

There is need for some type of phraseology to distinguish between these two positions.

Until something is standardized and to avoid confusion, use:

Number One on *taxiway.*
Number One on *runway.*
Number One on *final.*
Number One on *downwind.*"

***REX SAYS** — Until some other phrases are approved, I'll go along with the above.*

★ ★ ★

CONTINUALLY SWITCHING from Channel One to Guard Channel UHF while getting DF steers can be a dangerous practice.

The T-33 pilot had received an advisory of his plotted position and had been given a heading to fly to the nearest Air Force base. Every time the tower tried to contact him, he had switched channels. Twelve minutes later after subsequent steers had been given, a second advisory pin-pointed him in the same respective area.

Finally, he settled down on Channel One and was brought precisely over the airfield.

***REX SAYS**—This lad was working real hard to get the DF boys shook. Must have been frustrating to chase him through all 20 channels.*

★ ★ ★

HERE IS THE case of the dangling D-ring.

The pilot had tried unsuccessfully to airstart the F-86. He tidied up the cockpit, released the canopy and squeezed the ejection trigger. Up and back he went. At the top of the arc, the seat separated from him and he began to tumble. He grabbed for the D-ring, but no D-ring. His clutching fingers found the cable and followed it down until the ring was located. He yanked hard and the chute promptly opened.

His comments are pertinent.

If the D-ring is not held securely in the pocket, get it fixed. Take your parachute to the personal equipment officer or the parachute department and make them secure the D-ring.

***REX SAYS**—This is the third account that I know about where the D-ring has come out of its retaining pocket. If this should happen to you, remember that it will travel only about five inches. Seek and ye eventually shall find.*

★ ★ ★

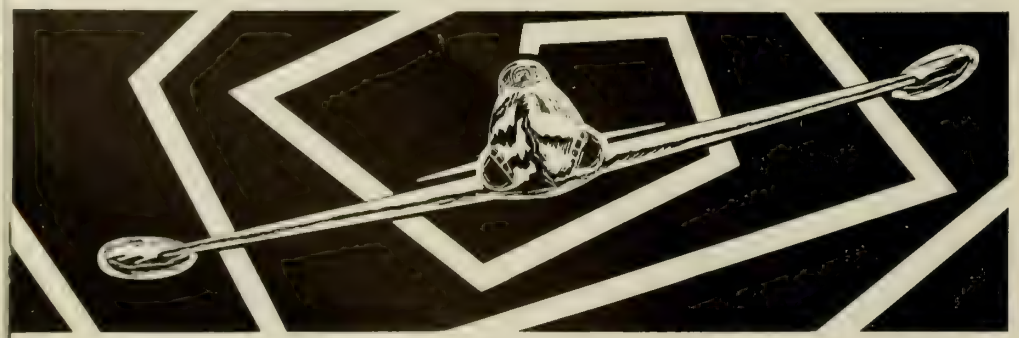
LOCAL EXPERIMENTS conducted at an Air Force base last summer had some very interesting results. With a ramp temperature of 90°F, the uncovered cockpit of a newly parked jet got up to 170°F in 40 minutes. Covering the cockpit with an aluminized canvas cover kept the temperature down to 120°F. Oxygen masks left in the uncovered cockpits became sticky and were damaged. Those masks left in covered cockpits were not so affected. MORAL — Get covers for cockpits and don't leave oxygen masks in uncovered ones when the temperatures are high.

***REX SAYS** — Nothing like a hot seat for a steaming stone.*

★ ★ ★

I'VE BEEN A crew chief on C-124s ever since our group received them. I've got as much rope and ladder time in them as some of our young copilots have flying time. I witnessed an incident recently that reaffirmed my belief that using the old rope and ladder routine is the best way to get up into and down from the lofty pilot compartment of a 124.

We were on the last leg of this flight. It was IFR with moderate turbulence. I was dead-heading this leg and was sitting in the cargo hold shooting the bull with a few of the passengers that we had picked up at our last stop.



The Big Brute was bouncing considerably. I glanced up and saw the copilot start down the ladder. Instead of facing forward and grasping the ladder or guide rope to help him descend as recommended, he faced aft and stepped down to the first rung. You probably know what happened. About half way down the ladder, a sudden gust caused the 124 to pitch real viciously.

He lost his balance and caught his arm in the flight deck door. By the time two of us reached him, he was dangling helplessly and yelling for assistance. Luckily, his arm was only badly bruised.

***REX SAYS**—Climbing down a ladder to success is just as important as climbing up the same ladder.*

★ ★ ★

I'M NOT SO HOT at this writing stuff so if old Rex will overlook my editorial ignorance, I'd like to pass on something of interest.

Not long ago a friend of mine, civilian type pilot, showed me a very interesting bit of reading. The literature was a Special Safety Alert bulletin, and the subject was an accident in which a pilot lost control of his aircraft in instrument weather shortly after takeoff. After a number of uncontrolled dives and climbs into the low clouds, his aircraft lost a wing and dived right into a nearby apartment building. The accident resulted in extensive damage and loss of life. The pilot was fatally injured.

During the course of investigation by the Civil Aeronautics Board, some important facts about the location on the aircraft of the Grimes anti-collision rotating beacon were brought out. I understand that the Air Force has the Grimes light on a few of our B-36, C-45, T-29 and C-131 types, so the findings of the CAB may be of interest to us.

Accident investigators became interested in the Grimes light when witnesses reported seeing two rotating beacons flashing brightly on the aircraft prior to the crash. Investigation led to the discovery that mechanics had warned the pilot of the fact that he had the two red rotating beacons installed too far forward on his aircraft. They had advised him that the reflected light from the beacons might prove serious, if not dangerous.

In order to determine the significance of these lights in relation to the accident, the CAB had two such beacons installed in the same location on an aircraft identical to the one involved in the accident. The aircraft manufacturers' own pilots conducted the flight tests, accompanied by a CAB safety investigator.

A test was made under IFR conditions. Both rotating lights were turned on when the aircraft approached scud at the bottom of the overcast. Upon entering each successive cloud tuft in the scud the upper rotating light produced bright red, intermittent, blotchy glares of far greater intensity than could possibly have been anticipated. The sweeping action from left to right introduced a degree of vertigo requiring the fullest concentration possible on the flight instruments to maintain control of the aircraft. The upper light was turned off and the lower light produced a similar result, though to a far lesser degree.

The aircraft was then pulled up into the solid overcast and both rotating lights were again turned on. The intensity of the glare from the solid cloud increased substantially over what it had been in the scud. The sweep of the upper light from left to right produced an intense bright red revolving glare within the cabin through a continuous arc of about 280 degrees. Simultaneously the lower light produced a contra-rotating glare through a broken forward arc of about 200 degrees. The combined result produced extreme vertigo in a very short time. No individual experiment could be continued safely beyond an interval of 30 to 40 seconds duration. A number of tests were conducted and in no case was the positive control of the aircraft possible beyond the approximate period of its inherent stability.

***REX SAYS**—If your outfit is slated to install the Grimes light, make sure that the following recommendations are observed. They are the result of the flight tests that CAA officials and company pilots discovered in solving this accident.*

- *The beacons should be mounted as far back on the fuselage of the airplane as possible, strictly in accordance with the T.O.*
- *Professional pilots turn off the beacons when actually flying in clouds, on instruments. The beacons are not intended for such use, but are only for VFR conditions or in restricted visibility.*
- *The installation should be checked for reflections. If adverse reflections are discovered, parts of the beacon can be masked to eliminate the dangerous reflection from the aircraft structure. UR where appropriate.*

★ ★ ★

GROUND CREWMAN congregate in our maintenance office quite frequently which accounts for the issues of FLYING SAFETY in our file becoming so dog-eared soon after they are received.

The other day a couple of crew chiefs were grousing about some pilots who do not dim or turn off their landing or taxi lights while their aircraft is being parked on the ramp.

Since ***REX SAYS*** is a sounding board for the odds and ends of flying, we wondered if he would "air" this problem facing ground crewmen.

With the full candle power hitting them smack in the eyes, it is a difficult job for them to park some types of aircraft. AFR 62-10 covers hand signals that ground crewmen will use but there isn't any hand or arm waving that covers dousing the lamps.

All they ask is that pilots slow down their taxi speed and when they turn into that final slot for the last few feet and see the fluorescent wands or flashlights beckoning to them, just reach up and flip that light switch off. It's easier on the eyes that way.

***REX SAYS**—Lights out. Well, not quite, but this maintenance officer has a valid idea. An aye for an eye.*

SOUND OFF

LETTERED IN RED ink at the bottom of a checklist in a base weather station is a message that exemplifies pilot reports (PIREPS). It reads, "Inflight and postflight weather reports help us to help you."

Many of you probably have seen such a sign, yet, how many of you have used or contributed to this service? There is one very good reason why you should know about PIREPS and use them, and that is the current, existing weather, used with a forecast, will give you the best idea of what to expect. And there is nothing so current as an accurate, promptly transmitted PIREP.

It's a foregone conclusion that once you understand how a thing works, you are more likely to accept it. So, for your understanding and acceptance here is an explanation of PIREPS. Use them to help yourself and at the same time, help others.

In addition to you, the primary users of pilot reports are the weather people. They use these reports in a variety of ways.

General Information

They use them on maps and in briefings and in making forecasts; they display these reports for the general information of aircrews, and they are used in special analysis of unforecasted weather phenomena.

What sort of weather conditions must exist to warrant a PIREP? Well, AFR 60-16 says you should report "any unusual weather conditions encountered that were not forecast." Assuming that you do run into some weather, not as forecast, it is important to get the word out immediately. So, all you have to do is contact the nearest radio facility and give them the information. Don't wait until you land to tell all.

There is a guide on the back page of the Radio Facility Chart that you should follow in giving a PIREP. It states, "Report weather encountered in the following sequence, APPENDED TO POSITION REPORT. Hazardous weather should be reported as soon as practicable.

- Any unusual weather.
- Turbulence.
- Icing, altitude encountered.
- Precipitation, type and intensity.
- Clouds, amount, type and height.
- Temperature.

Now, how does a PIREP get from you to a fellow pilot?

Suppose you are over the Austin, Texas radio range station, northbound, at 21,000 feet. The weather officer at Laughlin AFB, Texas, had forecast the possibility of isolated thunderstorms in the Austin area and sure enough there they are. Only one thing is wrong, however. They are not isolated; they have developed into a solid line of real bumpers. Being the conscientious type, what can you do to let the next guy who comes along, know about the new situation.

Simply get on the horn and give Austin radio the information.

Teletype Circuit

Austin radio, in turn, contacts San Antonio ARTC who puts the PIREP out on the normal teletype circuit. Lots of people can make use of your contribution. (In base weather stations, there are clipboards with the hourly sequence reports on them from civilian reporting stations. Your PIREP will show up there for the benefit of any pilot flying around the Austin area.)

In addition, the Austin radio broadcasts this information in the open immediately and includes it on the 15-minutes and 45-minutes past-the-hour weather reports.

Another example of the use of a PIREP is the report you give your local forecaster after takeoff.

The tower operator relays your report to the forecaster. After proper coding, it is reflected on the next hourly sequence with the letter A in front of it, which designates it as a pilot observation (aircraft).

How do weather people feel about PIREPS? When the weather is the lousiest, they are the busiest, but they are never too busy to have you bend their ear with a postflight report.

What do you do if a forecaster is deluged with anxious pilots waiting to leap off and you try to get to him with your inflight report? Very simple. Just latch onto one of his assistants. They'll log what you have to say on a pilot report form.

Write It Down

If you can't find a body to give this information to, don't give up in disgust. Put the facts down on paper or better yet, list them in the remarks section of your Form 175 and hand it to the Airdrome Officer. Let him know about it and he'll get the word to the weather officer.

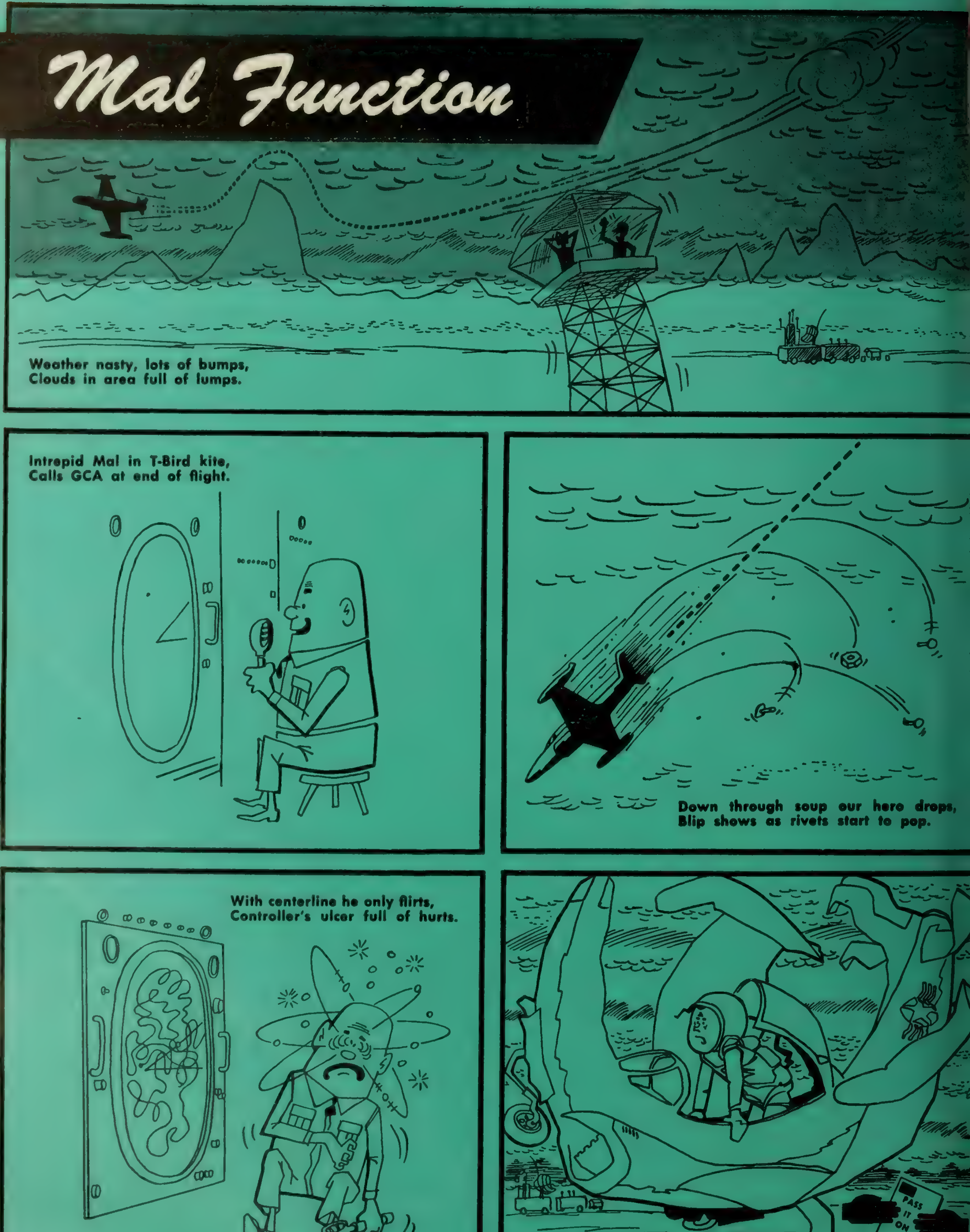
So there you are. All checked out on PIREPS. Avail yourself of the service and as the saying goes, "He who helps others, helps himself." So, help yourself with a PIREP. ●

the New Trim Look

Take a good second look—at the 'trim look' article on page 10—for some changes coming up on navigational charts. Like this little gal, you'll find them very neat and trim around the edges.

As for her ensemble, anybody for checkers? Your move.

Mal Function



Weather nasty, lots of bumps,
Clouds in area full of lumps.

Intrepid Mal in T-Bird kite,
Calls GCA at end of flight.

Down through soup our hero drops,
Blip shows as rivets start to pop.

With centerline he only flirts,
Controller's ulcer full of hurts.

Steep, steep turns not recommended,
Can end up in T-Bird bended.

°U. S. GOVERNMENT PRINTING OFFICE . . . 362334

629.1305
FLY S

FLYING SAFETY

UNITED STATES AIR FORCE

THE LIBRARY OF THE
UNIVERSITY OF ILLINOIS

JUNE, 195

You . . . from the same mold!
Page 2

FLYING SAFETY

VOL. TWELVE NO. SIX

- The C-130, Lockheed's new turbo-prop transport is introduced on page 16. Its missions range from close support to the carrying of paratroopers.

- Is Old Sol going to give you trouble this summer? Hot runways require special takeoff techniques. See page 24.

- "Death by Diversion" on page 12, is prepared by one of USAF's top flight surgeons. It should be "must" reading for you.

Here is an unusual view of the F-104. Overall length is three times wing span.

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major Jesse F. Townshend, Jr.

Associate Editor
Major V. R. Stutts

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby
T/Sgt. Chester McCubbin
T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune
A/2C Al Fagerwick
T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

You—From the Same Mold 2
"In Recognition of . . ." 7
Let's Summerize 8
Death by Diversion 12
Well Done 14
Turbo Transport 16
Keep Current 22
Sizzling Strips 24
Drip Blip 26
Round and Round You Go 28

★ ★ ★

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, July 6, 1954. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

How Well Can You Remember ?

If you miss more than four, better thumb through some back issues. And don't peek at the answers.

APRIL

1. High rate rolls are not recommended for:
    - a. *Early model F-102s.*
    - b. *Late model F-102s.*
    - c. *All F-102s.*
2. When landing on a wet strip, how many more feet of runway does a B-47 require?
    - a. *300-1000 feet.*
    - b. *1000-2500 feet.*
    - c. *2500-3300 feet.*
3. You can expect wind shear conditions to exist most often at traffic pattern altitude during:
    - a. *High noon.*
    - b. *Early morning.*
    - c. *Early evening.*
4. Fatty tissue is especially dangerous to pilots because it will:
    - a. *Cause bends.*
    - b. *Cause kidney disease.*
    - c. *Dissolve nitrogen in the blood.*
5. Recommended minimum ejection altitude using the automatic lap belt and parachute is:
    - a. *500 feet above the terrain.*
    - b. *1000 feet above the terrain.*
    - c. *100 feet above the terrain.*

MAY

6. On a GCA, final landing clearance is authorized by:
    - a. *The GCA operator.*
    - b. *The control tower.*
7. Successful Ground Controlled Approaches may be made with which of the following inoperative?
    - a. *Gyro instruments.*
    - b. *Radio transmitter.*
    - c. *Either or both of the above.*
8. The first job of an ADC interceptor is to:
    - a. *Write violation reports.*
    - b. *Identify unknown aircraft.*
    - c. *Assume control of violators.*
9. As a final resort, the drag chute may be used in spin recoveries on the F-100.
    - a. *True.*
    - b. *False.*
10. Scheduled CAA weather reports are broadcast at:
    - a. *The hour and half-hour.*
    - b. *15 and 45 minutes past the hour.*
    - c. *As they are received.*

JUNE

11. A gimmick called "Circular Polarization" is used to:
    - a. *Eliminate rain clutter on radar scopes.*
    - b. *Operate the Moving Target Indicator (MTI).*
    - c. *Reverse polarity at remote transmitter sites.*
12. The two prime requisites for a good standardization program are:
    - a. *Procedures and techniques.*
    - b. *Supervision and discipline.*
    - c. *Handbooks and Checklists.*
13. On the Allison T-56 engine installed on the C-130, the propeller:
    - a. *Is fully controllable throughout normal operating speeds (RPM).*
    - b. *Turns at a constant rate of speed.*
14. The C-130 is equipped with a hydraulic control boost system.
    - a. *True.*
    - b. *False.*
15. The most violent activity of a thunderstorm occurs in the:
    - a. *Lower two-thirds.*
    - b. *Upper one-third.*

ANSWERS

1.	a	6.	b	11.	a
2.	b	7.	c	12.	b
3.	b	8.	b	13.	b
4.	c	9.	a	14.	a
5.	a	10.	b	15.	a

You

In a previous article we looked at a few aspects of the pilot error problem. We saw that there is no real difference between pilot error and any other human error except in the circumstances and environment of its commission. The point being, obviously, that the errors made while flying are errors to be avoided because the circumstances lend themselves to disaster.

Many remedies have been tried for this chronic ailment, some of which appear to have had a little success. One of these is a gimmick called standardization, a rather popular word these days. Let's take a look at this standardization thing, what it is and what it can do for us.

* * *

THERE IS SUCH a thing as a pilot who never makes a mistake in judgment, who never miscalculates or guesses wrong. The performance of this pilot is fairly predictable and his psyche quite uncomplicated. Everyone is familiar with this pilot. In fact most people call him by his first name . . . George.

George is a member of a remarkable family of pilots whose performance, when properly used, is utterly standardized. Not being equipped with human brains, emotions or failings, they go about their duties in a professional, uncomplaining manner.

Some of George's more precocious children have gotten to the point where they fly solo. In fact the aircraft they fly no longer have cockpits—they're that good! One of George's most prodigious relatives performed a feat a few years ago that deserves special mention. He flew a C-54 from Clinton County AFB, Ohio, to Newfoundland, to England and return, all by himself. Takeoffs, landings, navigation, everything. A human pilot went along but for all intents and purposes, his sole function was to push one button and sit back. Oh yes, and to taxi in to the ramp after landing and fill out the Form One.

George and Standardization

Why our interest in George and his remarkable automatic relatives? Simply that George illustrates an ideal quality in a pilot—standardization. Built to perform a specific task in a specific way, George will always do it the same way as long as there is no mechanical malfunction in his innards. As far as George is concerned there is no "right way" or "wrong way." There is just one way to do the job—the way he was built to do it.

If we knew how to build George to react to every possible set of circumstances arising in flight, if we could now preset into him every conceivable mission we require of an aircraft, we could all retire to pasture. This day may come earlier than we care to think, but it hasn't arrived yet. So in the meantime we had best contemplate George and learn some lessons from him.

Back in the old gay days of stick-and-wire biplanes, of "seat of the pants" flying and "dead pilotage" navigation, there was little place in the scheme of things for George. Flying was a new game and full of question marks. It was accomplished with the help of gobs of imagination and improvisation. Performance of the aircraft was frequently precarious and unpredictable. Weather was an unknown, its forecasting still in the "red sky at night" and aching corns phase. Landing fields were where you found them. In this hairy business the only effective controlling force had to come from a human driver, loaded with resourcefulness, imagination and derring-do. For all his inherent short-

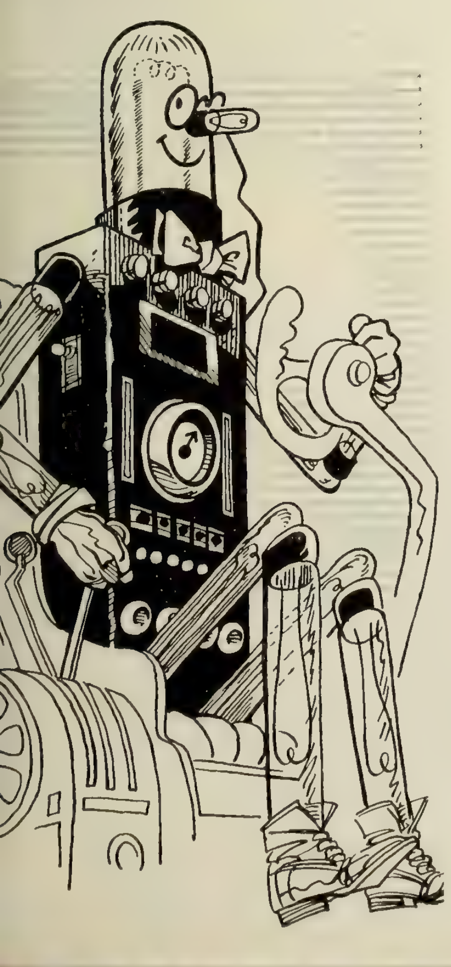
...from the same mold!

Lt. Col. Mitchell J. Mulholland, Safety Research and Analysis Division, D/FSR

comings, the variable human has the precious quality of adaptability. He can think, he can adjust to changing situations. He made aviation work.

Inevitably this early type of flying set a premium on individual initiative. It was a day of wooden planes and iron men. And a lot of men got separated from a considerable number of boys. Also, it was inevitable that the successful pilots came to be regarded as supermen—the death or glory boys, sing hey for the goggles and scarf! These were the days when a pilot was considered to be born, not made, when instinctive know-how was his most desirable attribute. One of the surest ways for a young hopeful to get washed out of flying training was to be convicted of "mechanical flying." And who, in the '20s and '30s, ever heard of a Dash-One?

George will always do it the same way just as long as there is no mechanical malfunction



Well, let's face it, this attitude was justifiable. It took a man with imagination and guts to make a precision operation out of the can of worms that the science of flying was at the time. Also, it is understandable that the old bold pilots who proudly wore their crowns under this system would resent a shift in attitude in the direction of mechanization of flying. It is further and finally understandable that flying under this old concept was an undeniably glamorous business and glamor is something we all love.

New Kind of Guy

BUT. Times change, for better or for worse. The inexorable march of scientific progress makes many lovely things obsolete. The wonderful old Air Corps has taken its place in the museum of nostalgic Americana alongside the Mississippi sternwheeler and the open-top Fifth Avenue bus. Our Air Force pilot today is a new kind of guy. His required ingredients include a lot more Einstein and a lot less Errol Flynn. The boy who once drank to the next man to die now drinks to the square root of pi.

We still have a mission to accomplish—more important than ever. Our airplanes still make a loud bang when they hit the ground, but the really loud noise you hear is the terrific impact on the national debt. Also, with all our progress, we still like to stay alive. So some things don't change. and we still have the job of keeping 'em flying.

When an airplane is built in this day and age, it is capable of performance perilously close to its design limits. The old cushion against the extremes of time, speed, temperature and structural stress is not as fat as it used to be. Our new birds are finely tuned instruments that will do wonders for us if we treat them exactly right. But let's not forget, they're not the forgiving machines some of the old ones were. They don't turn the other cheek when they're abused. Is this bad? Of course not. The B-17 had a safety factor like the 7th Regiment Armory. Automobiles used to carry two spare tires and a crank too. As we learn more, we can dispense with the excess cushion and as a result get more performance safely. Safely? Sure, as long as all the variables are under control. And these variables specifically include the pilot —you, and you, and you!

So there you are, and here we are, and we've got to stop being variable. And how do we do that? Part of the job of designing our new shiny birds and part of the job of directing their tactical employment is figuring out the right way to make them work. These airplanes are too complex, too exacting to be run just any way—there has to be one right way. Do it some other way and we know that something has to give.

We have all at one time or another encountered flying organizations that are obviously on the ball. Their operation is smooth, they don't have accidents. In short, they run professionally. Maybe the outfit you belong to right now is one of these. If so, more power to you. Anyway, one attribute stands out in outfits like this. If you ride with their pilots you find their performance remarkably alike. It doesn't matter which one you pick as your driver, the airplane is flown the same way—the right way.

Uniform High Standard

What these units have done is eliminate as far as possible the human variations between their people. Their pilots have been brought as close as

The death or glory boys sang Hey! Hey! for the goggles and scarf. Those were the days.

possible to a single common denominator, a uniform high standard. The pilot in such an outfit doesn't fly "my way" or "the way we did it in China." He flies in accordance with his unit SOPs which are in accord with the Dash-One handbook and all other appropriate directives.

The noise you now hear dimly in the background comes from the anguished but fading wails of the diehard flyboys out in the wings of the stage. They cry of "esprit de corps," of the "tiger spirit" and all the rest. They ask piteously if automation has invaded the pilot's domain.

Well, with a softly dropping tear for Lilac Time, we must admit the answer is yes. Automation has hit our happy home. It is the answer to guided missiles, and bids fair to be the answer to instrument flying, bombing, all-weather intercepts and a lot of flying missions. And until Robert the Robot is ready to sit in the left seat all the time, a sort of automation of our human drivers has to be the interim answer to our problems. We don't like a word like automation when we're talking about pilots, so we call it standardization. This we can do, gentlemen, and without losing a drop of "esprit de corps." After all, there's esprit and esprit, and the kind we're talking about, the kind we want, is not the show-off variety. If you're good, and want everybody to know it, then show it off by a perfectly carried out mission, not by flying under the James River bridge. You don't prove a thing by scaring the daylights out of people—you do prove a lot with a pair of command pilot's wings and an accident-free flying record.

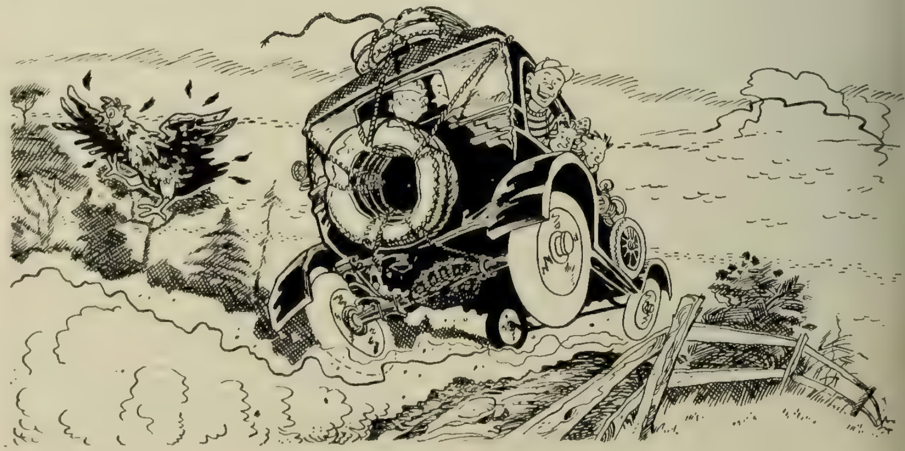
The pilots who fly the commercial airliners have been living with this concept for a long time and no one can deny it has paid off for them. And I haven't noticed many long faces at the airline terminal coffee counters. The Flagship and Mainliner people certainly are anything but wild blue yonder boys, but they seem happy. Their pride is professional, not flamboyant. And don't underestimate the personal satisfaction that comes from a professional job professionally done. Their feelings aren't hurt because each flies a DC-7 exactly like the next man. On the contrary, their qualifications are reflected by the fact that the passengers can't tell any difference.

The operating instructions on an Air Force aircraft go through quite a mill before Joe Pilot reads them. The manufacturers who build the airplane have the first say, and they ought to know. The flight test pilots at Edwards AFB and the engineers at Wright-Patterson all burn a lot of midnight oil before the Dash-One is laid before you. A lot of professional talent has gone into the production of the ungarbled word. All of which suggests that when Joe Pilot (Glutztown High School, Class of 1942) decides to differ with the Dash-One and go his own glorious way, some gall is showing someplace. Oh, we know errors appear in the book at times, and we learn new procedures and techniques from day to day, but these things should be passed on for decision by the people who know. Taking the law into our own hands can be a risky business.

Same Book, Standards

All right—we know we have the wherewithal, the machinery to standardize our pilots initially. If they're all taught from the same book and qualified under the same standards we're off to a good start. What's left? We have to be sure everybody adheres to these standards. Which brings

Automobiles used to carry several tires and a crank too. As we learn more, we can dispense with the excess cushion and as a result get more performance and still have a safer operation.



us to two indispensable ingredients of standardization. They are supervision and discipline.

Supervision—ah yes, one of those glittering generalities, sometimes regarded as a nothing-word, like "deep down locked-in goodness." We do abuse this word horribly, it's true, the same way we maul indoctrination and coordination. Well, what do we mean here? Simply that once you achieve something, you have to ride herd on it to make sure you don't lose it. If our pilots are trained to meet a standard, we must make sure they continue to meet the standard, and that the standards continue to be set. If you shoot an arrow into the air, it'll fall to earth you know not where—but you can be sure it won't stay up there. Neither will standard proficiency, unless you actively support it. Standardization, like anything else, means nothing if all we give it is lip service. If you want to know how your pilots are stacking up, the only way to find out is to fly with them—frequently. That way, if a man starts getting original ideas about how to work his machine you can spot it right away. If the idea is good, then get it to the right people so everyone can benefit. If it is no good, squelch it now before another statistic is made.

In an ideal, utopian organization the CO should be the best qualified pilot in the outfit, the man who knows the unit equipment best. His operations officer should run him a close second. In the old days this ideal was attained in some units, but today we must admit we can't do it. The old man in most cases has logged far more time with a mahogany bomber than in the current flying machine. The paper blizzard keeps him grounded much more than it used to. So the sharp lad with the airplane is likely to be a junior type who has been really logging current hours. This is how the stand-board pilot was born, how he came into his own. If properly used he is an invaluable man to have around. He is the expert on the unit aircraft; he knows it inside and out, and most important his knowledge is current. So he's the gent who can best do what the old man would like to do. That is to ride herd on the pilots in the outfit and make sure their qualifications and procedures are up to snuff. In its proper perspective his job is not one of required periodic checks, just to fill in squares on a chart. He should be the man with the most intimate knowledge of the real proficiency of the pilots in the organization, their weaknesses and strong points. He should be able to point the finger at areas where more training or corrective measures are needed. He should be a key man in helping the CO determine the capability of the unit.

In most cases, the paper blizzard keeps the old hands grounded a great deal of the time.

The airplanes of today are too complex, too exacting to be run just any old way—there has to be one right way. Do it some other way and something has to give. In short, let's be professional.

What's Discipline?

Now what's with this discipline? Indispensable to any military operation, sometimes we miss the application of this ingredient in flying. Discipline, as we consider it here, has nothing to do with desk-pounding, with punitive action, with hup, two, three, four and the rigid, quivering brace. Discipline is a quality which

has to infuse every level of command if it is to mean anything. It is something that has to come from the bottom as well as the top.

At its best it consists of a well-founded desire on the part of everyone to do the job right and of individuals to cooperate for the good of the group. If the people in an outfit feel this way, the unit has discipline. In case the highly technical nature of our mission tends at times to obscure this age-old military principle, it behooves us to remind ourselves that our job is fundamentally the same as that of our forebears at Saratoga or San Jacinto. Only the weapon is different.

Ours is a team operation, for the protection of our nation. Our team has many members and our organization is very complex, but as on any team the players must abide by the rules. Our rules are laid out for us. Every pilot or aircraft commander is a link in a chain of command. No T.O. space is provided for prima donnas. When he diverges from the set rule, a pilot is deliberately setting up an error. And heaven knows we have errors enough without setting them up for ourselves. Do it the right way and learn to like it!

Make It Work

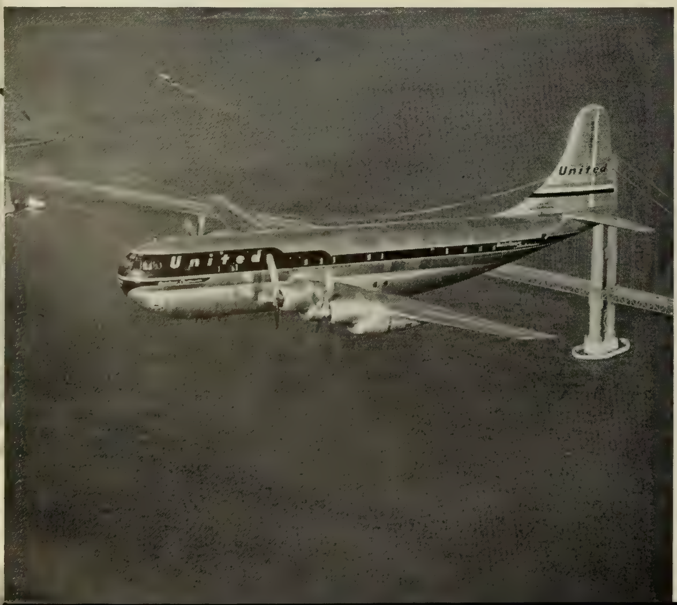
To make standardization work, then, the main ingredients of the program must be:

- A solid, well-prepared SOP to start with. In other words a standard to be met.
- Wholehearted command interest and support.
- A wisely chosen, highly qualified standardization board.
- Interest and support by the pilots themselves.

Proper use of a standardization program should result in a general raising of the proficiency level throughout a unit, and accordingly throughout the Air Force. What actually happens is a lowering of the "error-level" of the average line pilot and a consequent lowering of his accident expectancy. Less errors committed per flight mean less accident exposure per hour of flying. If we could reduce the error level to one-half of what it is, it doesn't take a mathematical genius to see that the pilot error accident rate would take a nosedive. And since pilot error accounts for half of our current accidents, what a bite that would take out of our overall accident losses! The machinery exists to do the job, and it can be done. Some of our commands and units have already achieved remarkable results with this concept. There is no reason why everybody can't do it.

Motorists wise may Simoniz—Aviators wise—standardize. ●

Careless flying doesn't prove a thing. You prove a lot with Command wings and a safe record. This concept is used by the pilots who fly the commercial airliners. It has paid off for them.



"In recognition of..."

JUST A MINUTE. Do you recognize this plaque? There aren't too many but maybe you've seen one hanging on somebody else's wall. And maybe you've wondered why it's there and what it means.

This plaque is there because everyone in that outfit has done his level best to put it there. It means that this unit is one of the best, for recent changes in selection criteria make this Flying Safety Award one of the highest peacetime awards that any unit can receive.

Air Force Regulation 62-9, recently revised, tightens control over the plaque and the letter of commendation "For Meritorious Achievement in Flight Safety." More units are eligible now to earn the citation but fewer awards are given than ever before and they're harder than ever to get.

Only ten Flying Safety Awards can be made throughout the Air Force for each six months period ending in June and December every year. This doesn't include two granted to Reserve units and two awards that may be presented to outfits in the Air National Guard.

To earn the Flying Safety Award your unit has to compete with every other unit in your Major Air Command. As outlined in AFR 62-9, certain basic flying time requirements have to be met. But, over and above these prerequisites, the contribution made by your unit to flying safety and to accident prevention is the primary consideration for the Award.

Acting on initial recommendations made by Major Air Commanders, a special Flying Safety Awards board appointed by the Deputy Inspector General makes the final decision. Some of the factors the board takes into consideration in determining where the awards will go, are as follows:

- Overall accident rates, taking into account the difference in accident potentials for different types and models of aircraft flown.
- Causes of accidents—whodunit and why.
- Experience level of flying personnel.
- Outstanding feats or missions accomplished.

That's why when an outfit receives the Flying Safety Award today it has a meaning you may have missed before. It means that the combined effort of everyone assigned piled up a safety record nobody else could beat. It represents outstanding performance of duty by everybody concerned with the completion of every mission flown. It means this outfit is among the best the Air Force has.

Remember this the next time you see the Flying Safety plaque. And remember it, too, when you go back to work. It takes some doing to take off in the birds today, to complete each mission safely and with the extra care that makes the routine job well done. But somewhere somebody does this every day. That's all it takes to help your outfit win one of the top peacetime citations, the Flying Safety Award. ●

Let's Summerize

Turbulence, tornadoes, squall lines and thunderstorms usher in summertime flying hazards. FLYING SAFETY feels that this article reprinted from Traveler, a CONVAIR publication, relates the facts in a concise, professional manner.

* * *

WEATHER IS of great concern to the pilot and, although he can't change it, he can in many cases avoid it and/or fly his airplane accordingly. He can't rely on old folks' tales or homespun methods of making predictions. He, like the weatherman, must depend primarily on barometric pressure, because he knows that changes in barometric pressure mean changes in weather.

Flight in turbulent air is one of the most frequent weather problems encountered by flight crews. The most severe turbulence, caused by temperature and pressure changes, results in thunderstorms, tornadoes, hail, ice or any number of weather phenomena.

Without radar assistance, either airborne or ground, the pilot must resort to other means of identifying turbulent areas. One such method is knowing something about clouds. They are weather telegrams hiding accumulations of water and snow, and they transmit their messages to anybody who knows how to read the signs. The pilot's knowledge of clouds helps him to predict the weather and to select a flight path of least turbulence. Although clouds are an important guide to weather, most rules concerning them can vary just as the clouds vary as they sweep across the sky.

All clouds, even the fair-weather cumulus and cirrus, contain water or ice crystals. The movement of air currents within a cloud stirs up these crystals and amasses them into larger crystals. When they become heavy, they fall to the earth either as snow or rain, depending upon the temperature of the layers of air through which they pass. If they pass through air layers that have freezing temperatures, they may fall to earth as snow or hail; if they pass through air that is warmer than freezing, they melt and fall to the earth as rain.

Whether flight is made in actual thunderstorm weather or in clear air, turbulence and the hazards that accompany it may be encountered. The pilot always must be defensively alert to avoid the hazards created by weather. Here's how to cope with the problems that are associated with turbulent flight:

- Maintain a predetermined turbulent air penetration speed.

- Maintain proper attitude.

A single turbulent-air penetration speed has been determined as most desirable for each type of aircraft. In the selection of this airspeed, consideration is given to structural integrity, gust intensity, aircraft gross weight, aircraft handling and the normal altitude operating range.

- Structural integrity can be compromised most readily by an undesirable combination of over-controlling (maneuver loads) and severe turbulence (gust loads). Modern structural design of aircraft provides sufficient strength to safely sustain a load 50 per cent greater than the limit load specified. Pilots can further protect the aircraft from structural overloads by flight at airspeeds commensurate with the degree of turbulence encountered. Airspeed, however, can be reduced to a point at which a severe gust will cause a stall, before load limits are exceeded.
- Gust intensity is completely a function of the prevailing atmospheric conditions and cannot be controlled.
- Aircraft gross weight is indirectly concerned in considering this problem since, generally speaking, nothing can be done to alter it in the event turbulence is encountered.
- Aircraft handling. It is well known that instrument flight at the higher airspeeds requires a greater degree of pilot skill and increased concentration. It also is well known that the effects of gust accelerations are greater at these higher airspeeds.

It should be noted that in none of the aforementioned problems is a high airspeed listed as being the best solution for flight in turbulence.

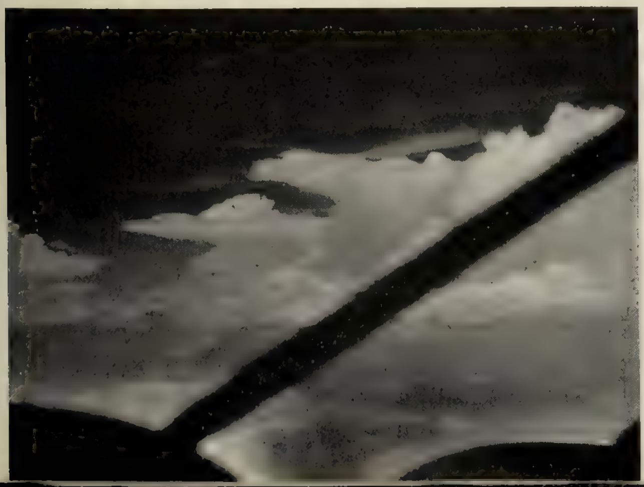
To this point, all of our discussion has been based on the effects of a single gust, in fact, on a theoretical sharp-edge gust. In reality, the possibility of a single gust causing an aircraft to stall is remote. Using the formula for transport aircraft of "stalling speed plus 60 knots," and a conservative stall speed of 90 knots, the aircraft would be flying at 150 knots or approximately 250 feet per second. In this typical example, the aircraft would completely transverse the gust in approximately one-third of a second.

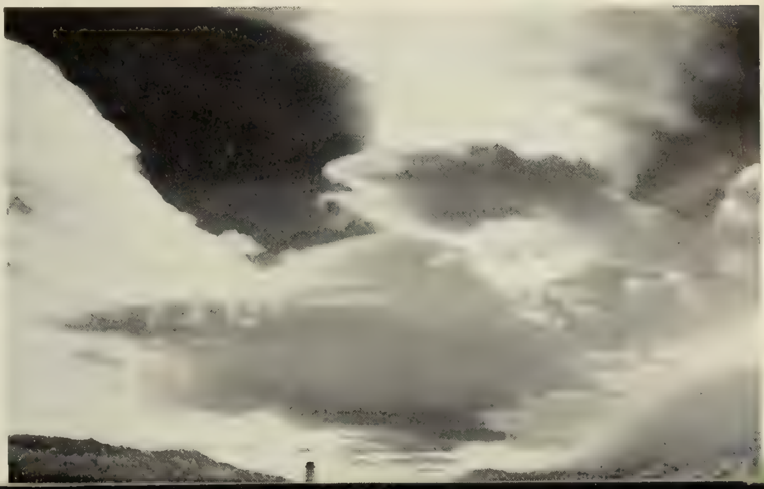
This example demonstrates that the problem of stalling in turbulence is not predicated only on a gust, but more commonly, from the failure of the pilot to use proper techniques to maintain the aircraft in a level attitude, at a predetermined turbulent-air penetration speed.

Thunderstorms

A thunderstorm always is associated with a large cumulus type cloud that has grown to unusual heights. The vertical growth of the cumulus cloud is due to an invisible rising column of air. Whether thunderstorms are caused by air being heated from below (air mass thunderstorms), or by air being forced up an inclined plane (frontal and orographic thunderstorms), they all have the same general characteristics. These strong updrafts of air, which are the basic cause of the thunderstorm, are offset by downdrafts, both within and outside the thunderstorm cloud. The result is severe turbulence, with the greater portion occurring ahead of the storm in the area known as the "roll cloud." The updrafts of air ahead of the storm and the downdrafts within the storm, cause the roll cloud to form at the base of the leading edge. Slightly ahead of this area on the surface, variable and shifting surface winds prevail. In and around the roll cloud is the region of maximum flight turbulence.

One method of identifying turbulent areas is knowing something about clouds. They are weather telegrams hiding accumulations of water, snow, and they transmit their messages to anybody who knows how to read the signs. The pilot's knowledge of clouds helps him select a flight path of least turbulence.





Eddies that occur along the edge of violent air currents result in the cauliflower appearance of the outside of the cloud. When these vertical currents rise beyond the freezing level of the surrounding atmosphere, it may develop into a cumulo-nimbus cloud, and a thunderstorm is likely.

The thunderstorm's identifying features may not always be visible because they can be masked by other clouds. Low-level clouds may hide the roll cloud, the dark rain area and the base of the actual thunderstorm. Multi-layer shelves of non-violent cumulus and stratus type clouds often extend for many miles in front of the thunderstorm hiding its anvil top from a low-flying airplane or its base from an aircarft at altitude.

When the atmospheric freezing level is relatively close to the earth's surface, as in the spring and fall of the year, tops of thunderstorms are generally low (15,000 to 18,000 feet). Realistically, these storms are not true thunderstorms, but rather rainshowers. The formation generally lacks an anvil top and a well defined or active roll cloud. The entire cloud has a cauliflower appearance with a slight veil of cirrus type clouds usually around the dome.

The thunderstorms that build up to 30,000 to 60,000 feet, however, are a different matter. The height to which these clouds extend is primarily governed by the distance between the ground and the atmospheric freezing level. The greater this distance, the higher the clouds and the more violent the thunderstorm activity.

The most violent activity occurs in the lower two-thirds of thunderstorm clouds. If it is 30,000 feet from the base to the top of the cloud, you may expect the greatest turbulence in the lower 20,000 feet.

At night, lightning is usually the first warning of thunderstorms ahead. The region of the most frequent lightning flashes is ordinarily the most violent point within the storm. If more vertical than horizontal flashes are observed, it indicates that you are approaching the storm from the front, where there is greater violence. Conversely, if you see more horizontal than vertical flashes, you are approaching from the rear. If horizontal flashes are the only type observed, the storm is mild and its base is well above the surface of the earth.

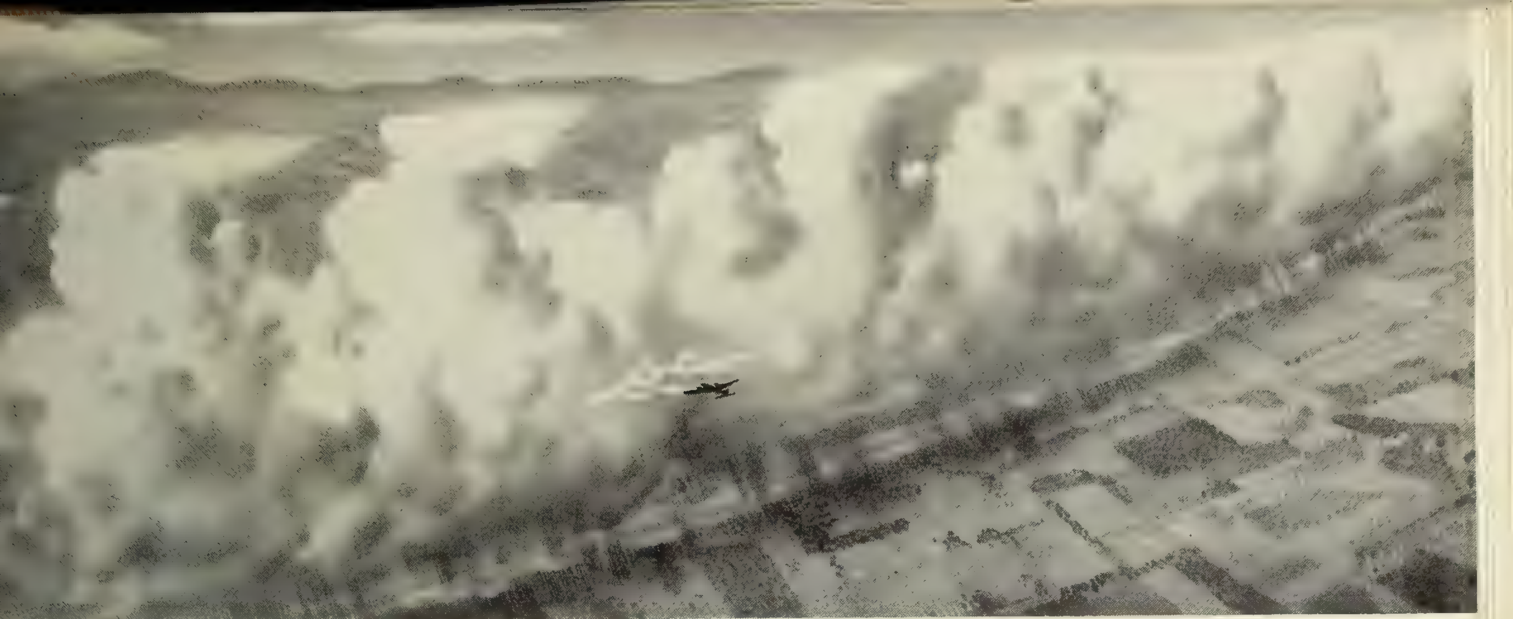
The anvil top of the thunderstorm consists primarily of ice crystals. The anvil top is above the turbulent activity of the storm.

Hail forms in the chimney of the thunderstorm at an altitude above the freezing level. Hailstones are balls or irregular lumps of ice which may vary from the size of a pea to that of a baseball. Severe aircraft damage from hail is exceedingly rare. It takes a vertical current of air exceeding 150 knots to suspend the larger hailstones, and ordinarily the updrafts don't exceed 60 or 80 knots.

Pilots have experienced heavy hail in the clear air outside a thunderstorm, which seems to support the theory that the worst hail is generally encountered around the main storm cloud and underneath the overhanging shelves, rather than in the region of heaviest rain in the core of the storm.

Squall Lines and Tornadoes

Squall lines and tornadoes can provide the worst possible flying condi-



There is a possibility that one or more tornadoes may develop in the vicinity of a squall line. They apparently grow out of the roll cloud, often occur along or in advance of the cold front.

tions. During their first few hours of life they are composed of a continuous line of severe thunderstorms. In addition, there is the possibility that one or more tornadoes will develop in the vicinity of a squall line.

Squall lines are rather difficult to forecast. They occur in all degrees of intensity, but for every severe one there are many of slight or only moderate intensity. The squall line is essentially a cold front phenomenon. Unless cold air replaces warm air and also overruns it, a squall line will not occur. Almost any cold front may be a squall line breeder; however, the squall line may be well past the formative stage before it is identified on map analyses by forecasters. Thus, it seldom appears on 24- and 36-hour forecast maps.

Studies of squalls and successful flights through them indicate there is no preferred altitude or level for penetration of violent thunderstorm activity. While squall clouds occur at a height of 5000 to 7000 feet, turbulence may extend twice as high.

If a clear space a mile or more in width is evident, penetrate at that spot because the vertical velocity gradients near the center will probably not be severe enough to prevent safe transit.

A tornado is a violent whirling storm usually a few hundred yards in diameter, having intense cyclonic winds reaching velocities of 200 to 600 mph. Tornadoes differ from hurricanes in both their size and duration. They may occur at any time during the formative stages of a squall line. They result from extreme instability and are usually associated with severe thunderstorms. They apparently grow out of the "roll cloud" as it bends down toward the surface, and usually occur along, or a short distance in advance of a cold surface front between mP and mT air.

A tornado is the most violent of storms, but its life span is exceptionally short, approximately one hour for the average storm, with a track over the ground usually less than 25 miles in length. Its appearance is so typical and its size so limited in daylight it is easily recognized and its path avoided without difficulty. Because, like thunderstorms, they travel with the wind, the path of an observed tornado may be roughly forecast, and such areas avoided. (See "Tale of the Twister," FLYING SAFETY, March 1956.)

Areas of Turbulence

Thunderstorms present a problem to the pilot that cannot be disregarded. When encountered in flight, thunderstorms and other related areas of turbulence should be avoided by any of the following methods:

- Circumnavigation.
- Flight below the base of the storm, if a terrain clearance of 3000 feet can be maintained.
- "Over the top."
- A precautionary landing can be made until the thunderstorm passes.

Use the following pertinent conclusions to help you make your decision:

- When encountering cold-front thunderstorms or other extended lines of thunderstorms, where individual thunderheads are separated by clear areas within accessible altitudes (10,000 to 18,000 feet), flights can be conducted through these clear areas and above lower levels of clouds. Do not fly closer than 2500 feet to the cumulo-nimbus build-ups.
- Do not fly in the immediate vicinity of a thunderstorm or a line of thunderstorms, when below an intermediate level overcast. Thunderstorms have a tendency to expand above stratus type clouds and may release heavy rain or hail outside the actual thunderstorm itself. Severe turbulence may be encountered also due to the instability of air in the immediate thunderstorm area.
- Do not attempt flight below prefrontal thunderstorms or cold-front squall lines.
- Summertime thunderstorms occurring at night, not associated with any frontal activity, develop at relatively high levels and are usually weak in intensity.
- Extreme care should be exercised when descending toward a thunderstorm with the intention of flying below its base. The normal glide path of the airplane may be increased by downdrafts, and the rate of descent and indicated airspeed may increase beyond limits. Such descents should be conducted carefully at a greatly reduced airspeed.
- Never attempt to fly through a squall line or cold front thunderstorm unless you have positive knowledge that the individual squalls are loosely connected and can be safely circumnavigated, or unless it is definitely known that flight can be conducted between the build-ups and above the tops of all lower level clouds. ●

Death by Diversion

Colonel H. G. Moseley
Chief, Aero Med. Safety Div. D/FSR

A CERTAIN percentage of aircraft accidents are never explained. No matter how much effort is put into the investigation, it simply cannot be determined whether the accident was caused by materiel failure, some action the pilot did or did not take, or some other cause. However, among some of these unexplained accidents we find a pattern which periodically recurs. All pilots might do well to look at this pattern and try to avoid it. This is of some importance because the accidents which are about to be described are invariably fatal. Here is the picture.

- The aircraft which are involved and which are about to be destroyed are always jet fighters or interceptors.
- The pilots involved are usually young and relatively inexperienced, although pilots of any age may enact this tragedy.
- The stage of flight is usually somewhere in the landing or approach pattern, although it may occur shortly after takeoff.
- The altitude is relatively low, usually around 2000 feet.
- The aircraft speed is usually around 350 knots.
- The aircraft is often in a procedure turn.
- Flying conditions are IFR. The pilot is either in the soup or it is a black, black night.
- The pilot is requested to change radio channels or modes, or is in a position where routine channel changes should be made.

When flying under IFR, close to the ground, any diversion can be dangerous. Changing radio channels, modes, during procedure turn falls into the category of possibly dangerous diversion.

After the pilot has been requested to change channels, he "Rogers." Or, if it is a routine change he may announce that he is changing to channel 2 or 4 or whatever it may be.

Almost immediately thereafter, the aircraft strikes the ground with terrific velocity and oftentimes in a near-vertical attitude.

As we said before, there are no survivors, and nothing can be found in the wreckage to indicate any type of materiel failure.

So the cause of the accident remains undetermined.

However, in any aircraft accident investigation if we can answer the question of "What was the last thing the pilot was doing or attempting to do?", we can get a good lead on the probable cause of the accident. In these accidents the answer to that question is relatively simple. The last thing the pilot was doing or attempting to do was change radio channels or modes.

"So what?" one may ask. Radio channels or modes are changed all the time without flight being brought to a shattering halt. However, let us look at the position of the radio channel or mode selector which this pilot was trying to handle.

Almost without exception, the aircraft involved in the above pattern have had the radio channel or mode selector far to the rear on the right console. In order to change channels the pilot has to use his right hand and fly with his left. In order to look at the channel or mode selector and see what is being selected, it is necessary for him to turn his head, and look down and to the rear.

Remember, flying conditions are IFR and the pilot is often in a procedure turn. In other words, it is 100 per cent instrument flying. Under these conditions, the pilot who looks to his channel selector must quit monitoring his instruments even if only for an instant. But even in this instant, it is easy to allow the nose to drop or a wing to go down or otherwise deviate somewhat from the desired flight path.

Is this important?

The importance is best illustrated by some experiments which were done a few years back at Wright Air Development Center. In these flight tests, experienced pilots were placed in the left seat of a light transport aircraft and while the copilot flew, they were blindfolded. Then the aircraft was placed in a slightly abnormal position with one wing or the other down, or the nose up or down, and then the blindfold was quickly removed and the pilot was required to recover on instruments. He was timed to see how long it had taken.

It took on the average of 11 seconds for these experienced pilots to again attain level flight by the use of flight instruments.

Sometimes when a wing was down, the immediate response to right the aircraft was in the wrong direction. In other words, instead of trying to bring the aircraft level, the pilot tended to turn it over on its back.

What does that mean to the pilot of our jet fighter or interceptor flying IFR 2000 feet above the terrain? It means that should he accidentally wingover or become diverted and get the nose down, he can strike the ground in less than five seconds.

So here we can say with a fair degree of certainty that these unexplained accidents were probably the result of the pilot's letting his attention be diverted by the radio channel frequency selector.

To help prevent this, the Air Force is rapidly changing the position of the selector in many of these aircraft so that it can be easily handled. In addition, experiments are being conducted to determine whether or not it is feasible to place a small channel indicator somewhere on the instrument panel. Either method will allow the pilot to see the channel he is selecting without turning his head.

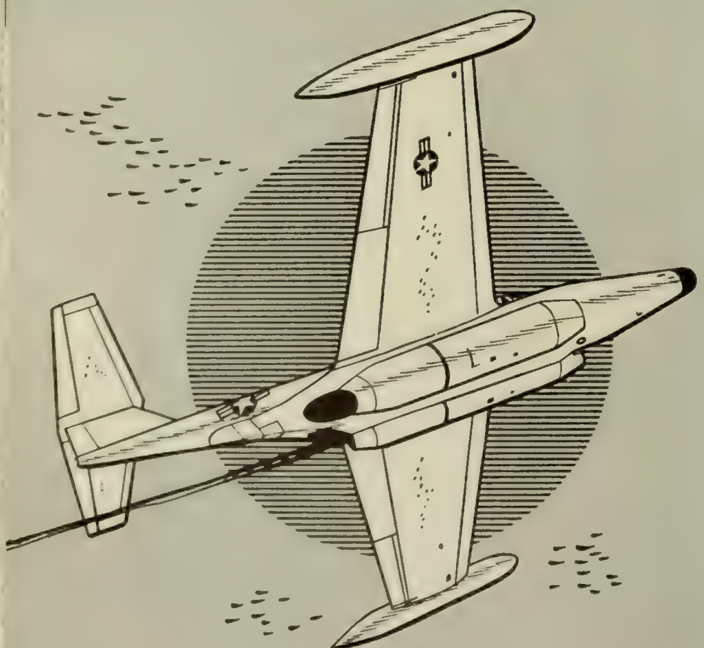
However, the important thing is not just the position of the radio channel selector. What is really important is not being diverted no matter what the cause. It is a matter of staying ahead of the game. When a pilot becomes diverted from his instruments during critical stages of flight, he has lost the upper hand. And once those gyros go berserk and the altimeter unwinds, there may be precious few seconds remaining. ●

Captain

Richard A. Jones

433d FIS, AAC

★ WELL



SCHEDULED TO test hop an F-89C, following a left engine change, Captain Richard A. Jones taxied the aircraft to runup position. After completing the required engine and pre-takeoff checklists, he started the takeoff roll. Immediately after the F-89 became airborne and as the gear was retracting, an explosion occurred in the left engine. The cockpit filled with smoke and the left engine fire warning light came on. Captain Jones shut down the engine, dumped the tiptank fuel and pulled the left engine fire extinguisher handle.

He started a 180 turn back to the field. Through the smoke he could see that the fire warning light was still on, so he decided to crash land on the runway.

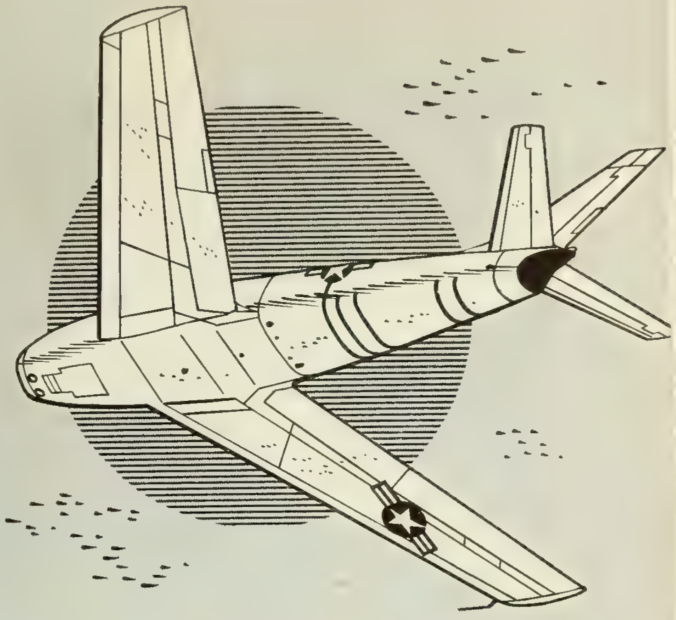
Upon completion of his turn, the smoke had dissipated and the fire warning light had gone out. Low on the final approach, and with the gear indicating an unsafe position, he decided to try to save the aircraft. Using full power on the right engine, he completed a successful single engine go-around pattern. He extended the gear by use of the emergency system and landed safely.

TRA

KNOW

During this short flight, Captain Jones was never able to fly the '89 more than 200 feet above the ground. The flight path beyond the ends of the runway was either over a densely populated area or rough, hilly terrain.

Captain Jones' professional knowledge of the performance and systems of the '89, a desire to save the expensive aircraft and his superior flying skill reflect credit upon himself and the U. S. Air Force. Well Done!



I N G

DONE ★

1st Lieutenant

Albin Oparowski

146th FIW, Calif ANG

E D G E

1ST LT. ALBIN OPAROWSKI was number six man in a flight of six F-86s on a night navigation mission. Takeoff was shortly after midnight. Upon reaching cruising altitude at 35,000 feet, he felt a slight vibration in the engine. Then it flamed out. Lt. Oparowski immediately placed the throttle in the stopcock position, established a glide of 185 knots, turned the IFF set to the emergency position and notified the flight leader.

He was flying above a solid overcast. Thunderstorms extended above 35,000 feet, and the high mountains in the area ranged from 6000 to 12,000 ft. high.

At 25,000 feet, Lt. Oparowski attempted several airstarts. None were successful, although he used both normal and emergency fuel systems. He made a decision to eject at 15,000 feet. However, just before reaching this altitude, he attempted one last airstart. The engine rumbled and the tailpipe temperature started to rise. He had to use his flashlight to read the instruments because the battery was very weak. When the tailpipe temperature continued beyond the allowable red marks on the instrument gage, Lt. Oparowski retarded the throttle. Again, the engine flamed out. At this time he broke out under the overcast and saw the airfield at Flagstaff, Arizona.

He then made a successful airstart and flew toward the airfield, using only partial power. Setting up his landing pattern, he landed safely on the 6300-foot strip.

For his superior flying ability in an emergency situation, Well Done!

C-130 features four, constant speed turbo-props.

C-130 TURBO TRANSPORT

Major Joseph P. Tracy
Safety Education Division, D/FSR

You can handle the Hercules with one hand in the landing pattern. Below, it is very stable in all flight configurations and gives you an honest warning on all stalls.

EVER SINCE THE YC-130 first lifted off the runway at Burbank, California, we've been following the development of the machine with a great deal of interest. It's not a particularly big airplane when compared with such aircraft as the C-124 or the C-133, but it appears now that it can carry a whopping load on relatively short hauls and in all probability beat the tar out of its bigger brothers when it comes to speed. In all fairness, this is a comparison only to acquaint you with size difference rather than performance.

The C-130A is one of the first turboprop jobs and from our limited flight experience with the plane, we'll make book that such type power is here to stay. True, there are still some bugs to be ironed out of the propeller system and we look for a few minor modifications in the bird itself. However, on the whole, the Hercules is nearly ready for operational absorption into the Air Force and as this is written, preliminary USAF crew training has commenced.

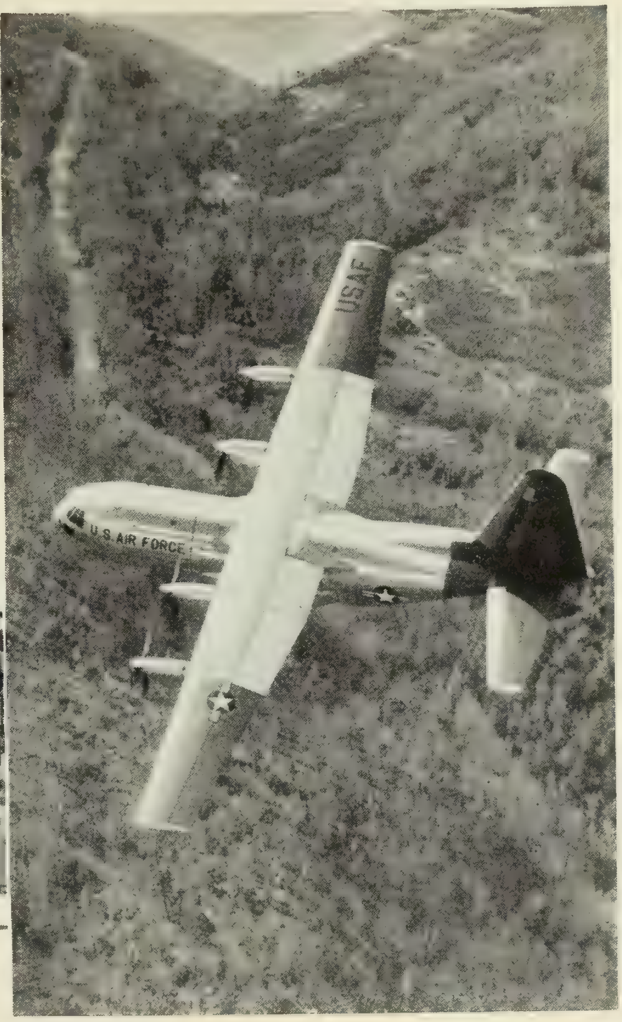
Through the good offices of Mr. B. A. (Bud) Martin, Chief Pilot of the Georgia Division, Lockheed Aircraft Corporation, arrangements were made for FLYING SAFETY to get acquainted with the C-130A and to do a bit of flying in the aircraft. We're not going to even try to give a complete flight evaluation at this time but we can say that it is a kindly machine with no apparent bad habits.

You'll be seeing more and more of these high-tailed dudes in the near future. Its distinctive profile is hard to miss. If the upswept empennage deludes you into thinking that it's a C-123, just glance at the Roman nose and there won't be any doubt in your mind. The front of the C-130 resembles a goat but you may rest assured it's nowhere near as stubborn.

Versatile Transport

Getting down to basics, the Hercules is a high-wing, all-metal construction, medium-range, land-based transport. That's what the book says. Its mission is to provide rapid transportation of personnel or cargo for delivery by parachute or landing. It can be used as an assault transport carrying 92 ground troops or 64 paratroops and equipment, and it can be

This article features the C-130A, Lockheed's brand new, turbo-prop transport. Powered by four Allison, T-56 engines, the "Hercules" will soon be operational in Air Force units.



The Hercules is 95 feet long, 38 feet tall and has a wing span of 132 feet.

converted for ambulance or aerial delivery missions.

Power for this aircraft is supplied by four Allison T-56-A-1 turbo-prop, constant speed engines. We'll discuss power plants later. When delivered to the customers, each engine will drive a three-bladed Aero-products constant speed propeller having full feathering and reverse pitch.

The fuselage of the C-130A is divided into the cargo compartment and the flight station. After climbing four steps to get into the main compartment, it is necessary to scramble up four more to get to the pilot's office. You're a fair distance off the ground.

An auxiliary power plant, consisting of a gas turbine compressor and air turbine motor, provides a ground source for engine starting, nacelle preheating and air conditioning. The air turbine motor provides emergency hydraulic pressure and D.C. power for both air and ground operation.

The landing gear system is actuated hydraulically and consists of a dual nosewheel and two tandem mounted main landing wheels on each side of the fuselage.

Cargo may be loaded either through the forward cargo door on the left side of the airplane or via the aft cargo ramp and door. Loading through the forward door is done at truck-bed level. The aft door can be opened and the ramp lowered. The aft cargo door and ramp are used for aerial delivery. Paratroop jump doors are located forward of the ramp hinge line on each side of the airplane. The doors are guided to an overhead position within the plane when opened. Electrically actuated air deflectors are located just forward of each jump door.

And finally, just for a few last figures, the C-130A has a wing span of 132 feet. It is 95 feet long and sticks up in the air for 38 feet at the top of the rudder. If the engineers are right, this gal will gross out at 108,000 pounds which sort of takes it out of the Cub category.

Probably the most important difference between the C-130A and any aircraft you've flown previously is the power plants. In essence the manufacturer has taken a gas turbine and combined it with a propeller. This is sort of a double-barrelled shot for not only is ample power supplied by the propellers for all the pull needed but a bit of jet augmentation is an everpresent booster as well.

Two Assemblies

Like for any jet engine, the ideal fuel is JP-4. However, in an emergency, aviation gasoline may be used with, of course, the penalty of decreased efficiency range-wise.

Each T-56 engine consists of two assemblies: the power section, containing the gas turbine, and the reduction gear assembly, having a single propeller shaft.

The power section has a 14-stage compressor and six through-flow-type

Opening the loading doors in flight has no effect on the flying characteristics of the plane. If the loading ramp is lowered full down, a slight nosedown tendency is produced. Add power.

combustion chambers which port directly to a four-stage turbine. The power section also provides an accessory drive decoupling assembly, a propeller brake, an engine negative torque control system and necessary gearing to provide a 12.5 to one reduction in propeller shaft speed. This results in prop speed of 1106 rpm at 13,820 rpm, normal engine speed.

Now you might just as well try to follow the rest of this business. Maybe it's a bit on the dry side, but if you can get a reasonably good picture in your mind as to the "how" of the turbo-prop assembly, you won't be floundering completely the first time you fly behind one.

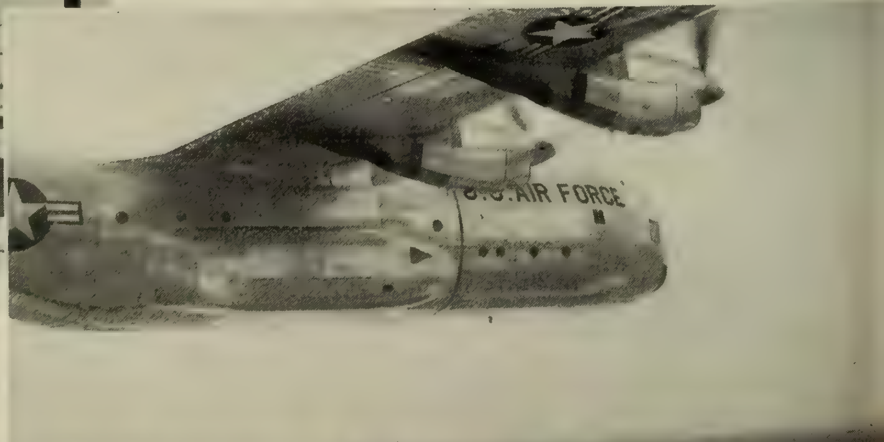
Axial Flow

Back to the T-56. Air enters the engine airscoop and is progressively compressed through the axial flow compressor. This compressed air flows through the diffuser into the combustion section. This section consists of six combustion chambers where fuel is introduced and the fuel-air mixture is burned. The resultant hot gases pass through the aft ends of the combustion liners and expand through the turbine section, causing the turbine to rotate. The turbine then drives the compressor rotor and the reduction gear assembly. The gases travel from the turbine through an opening formed by the inner exhaust cone and the turbine rear bearing support. From there on, gases are discharged almost as a jet and that explains the jet augmentation effect.

At this point, let's remember that the Allison T-56 is a constant speed engine. Remember too that the propeller turns at a constant speed while in flight and if that sounds a little confusing, it is. Here, however, is a simple explanation of the whole thing.

If the pilot wants more power from

Cargo can be loaded through aft cargo ramp and door. Paratroop jump doors, below, have electrically actuated air deflectors in front of them.



The Hercules can be used as an assault transport carrying 92 ground troops or 64 paratroops and equipment. It will gross out at 108,000 pounds. It can carry a whopping load on relatively short cargo hauls.

his engines while tooling along in the blue, he opens the throttles. That's fair enough. In this case though, the throttles are known as "power levers." Okay, so he opens the power levers a little and feeds more fuel into the engines. Unlike anything you've flown before, there just ain't no more increase in RPM. Because why? The mills are already turning up 100 per cent. Naturally, there's only one other out and maybe you've already guessed the answer. As the power levers are moved forward the propeller blade angle increases. End results? More speed and if you don't think this takes a bit of complicated gearing, governing and fuel scheduling, you're wrong. However, it works!

Negative Torque Control

Two inherent safety devices incorporated are the decoupling set-up and the engine negative torque control. The coupling is provided to disengage the reduction gear in the event the power unit is operating below approximately 400 ft/pounds torque at the power unit. This means that in the event of an engine failure or an abnormally rapid reduction in power setting, the decoupler goes to work and physically separates the propeller coupling from the engine and leaves it in the free-wheeling state. Normally, if an engine fails on a reciprocating engine, the pilot can feather the propeller. Such is the case with the T-56. But, in the event of internal failure of the engine, you can see what might well happen if the prop didn't have some system ready to snap it into free-wheeling until things got under control a bit. The decoupler takes care of such emergencies where the pilot may not have the time to feather normally.

The engine negative torque control is installed on all engines. The purpose of this unit is to limit the negative thrust horsepower that may occur during engine failure. There are three things which could cause a negative torque load to be applied to the engine: (1) a rapid power reduction; (2) a severe gust; (3) engine failure or flameout. As long as the power section is driving the propeller, the engine negative torque control will remain inoperative. If the propeller attempts to drive the power section, the engine negative torque control senses negative torque, and at about minus 275 horsepower, actuates the propeller pitch circuit, moving the propeller toward feather condition. As the propeller starts toward feather, the negative torque decreases, causing the engine negative torque control unit to become inoperative when the negative torque drops below the minus 275 horsepower value. The propeller blade angle will then return toward the governing range. If the negative torque rises again, the same cycle will automatically recur and the negative torque will be limited to the minus 275 horsepower.

The first time you climb into a C-130A, you're going to be facing a new control quadrant set-up in some respects. A couple of the more important things are the power levers and the condition levers.

The four power levers are quadrant-mounted on the flight control pedestal. The quadrant is divided into two ranges. The taxi range is the section of the quadrant between MAXIMUM REVERSE and FLIGHT IDLE positions. In the taxi range, all ground operating controls are in effect. Further movement of the power levers forward of the FLIGHT IDLE and up to the TAKEOFF position places the engine in the governing range. Now, in this range, all controls for both fuel and propeller are automatically set for flight requirements. A step or detent, located at the FLIGHT IDLE position, prevents accidental movement of the power levers into the taxi range.

Condition Lever

The other controls we spoke of, the condition levers, have the following positions: AIRSTART, RUN, GROUND STOP and FEATHER. Placing a condition lever in the AIRSTART position energizes a circuit which turns the propeller blades to a present angle suitable for starting the engine in the air. When the engine is started, the condition lever is released to the RUN position.

Placing the condition lever in the GROUND STOP position removes power from the ignition exciters, shuts

". . . gear up, flaps up, nose up and you're on the way up, too—but good."

Quick loading of many types of cargo makes the C-130 an ideal medium-range transport.

off fuel to the engine and engages the propeller brake as the prop slows down. And lastly, moving the condition lever to FEATHER opens the normal propeller circuits and runs the propeller to the feather angle. From this you can see that a condition lever is sort of a combined mag switch, mixture control and feathering button. As a matter of fact, forthcoming condition levers will have the familiar standard mixture control knob configuration.

There are a goodly number of toggle switches and circuit breakers scattered around the office that the pilot must become familiar with but the power levers and condition levers will be the two controls new to the average driver. One thing we like is the fact that almost everything is within reach of either the pilot or copilot.

The C-130A uses heat for anti-icing, has an extremely simple fuel system, a normal oxygen system that we're all used to; has a pressurized cabin (including flight deck and cargo compartment) and generally is an aircraft that will be pretty much normal to the average cargo-type driver. The anti-skid brakes will come in mighty handy during crosswind landings or touching down on icy runways.

Okay, let's say that we've gone over the airplane carefully and it's time to leap off. That takes care of takeoff performance. It just leaps off, period. You run the power levers up to maximum TIT (turbine inlet temperature, 927°C.), release the brakes and rather casually nudge the nosewheel steering as needed. The airspeed comes up fast and in nothing flat you're airborne. Eight hundred feet or so ground run and—jump! Sure, that's empty, but pretty fair performance for an airplane that weighs in this heavy.

Steep Climb

On your first takeoff, you'll be startled by the steep angle of attack that constitutes a normal climb. As a matter of fact, we found it a trifle uncomfortable. You sit there on your tailbone and wonder what's going to happen. Gear up, flaps up, nose up and you're on the way up, too—but real good.

The C-130A has no apparent bad habits. We checked it rather carefully in all possible configurations and at practically all speeds. It accelerates fast when the power levers are advanced; it's very stable under all flight conditions. There are no heavy control loads and response is positive.

Honest Warning

This plane gives a lot of honest warning before stalling, power on or off. The buffet is pronounced but not in the least violent and there is no evidenced tendency to fall off on a wing. We found that even when completely stalled, aileron and rudder remained exceedingly effective.

It doesn't appear that an engine failure in flight would present too much difficulty. We tried shutting down and feathering each mill right across the board and had no trouble holding altitude and heading.

Each pilot has a trim button on the control wheel, so located that it can be reached and actuated by thumb pressure. In the event one trim button is actuated too much or for too long a period by either pilot, the other can stop the operation at any time by merely applying opposite trim. Then, too, a manual trim toggle is located on the pedestal beside the pilot which will override both trim buttons. This arrangement should prove very helpful during student or transition training.

. no sweat in getting reverse thrust. It's like hitting a brick wall."

Because of the ease of handling, a few words on the control boost system appear in order. A booster hydraulic system, a utility hydraulic system and an emergency hydraulic system distribute pressure to the hydraulically operated parts of the airplane.

The booster and utility systems are interconnected to the extent that normal operation of the aileron and elevator boost cylinders make use of pressure from both sources. The utility hydraulic system also serves as a standby source of pressure for operation of the rudder boost cylinder in case of a pressure failure in the booster system.

Three Hydraulic Systems

The emergency hydraulic system can be actuated for emergency landing services and normal or emergency ramp operation. Normal operating pressure for the systems is 3000 psi.

The C-130A is a beautiful flying machine. However, with the boost off, the picture changes rather drastically. It is possible to fly this brute by straight manual control but we guarantee it to be a two-man job in every sense of the word. Of course, with three hydraulic systems to depend on, the chances of complete boost failure are remote.

Preliminary USAF crew training has commenced in the C-130 at Marietta, Ga. plant.

We noticed a tendency to overcontrol the ailerons a little at first. Wheel pressure is very light and it took a bit of experimenting to get the hang of leaving that control alone. T-bird drivers and fighter jocks will appreciate what we mean, although the '130 isn't quite as sensitive as fighters.

Landing the C-130A doesn't present any particular problem. In fact, it's an easier aircraft to set down than many we've flown. We found it to be an entirely normal machine in all respects except for quite a lot of burbling after the gear is extended. This is a peculiarity of the C-123 also and apparently is induced by both positive and negative airflow in the wheel wells. This makes the plane quite noisy after the gear is down and the buffeting is a trifle uncomfortable. But, there is no control problem.

On the final approach, airspeed is held approximately 20 knots above the computed stalling speed right on down to the deck. Control is excellent and you'll like the ease of handling with one hand.

Reversible Props

The reverse pitch feature of the C-130A is really something. It's necessary to go through the usual "lift-to-reverse" act on the quadrant and then haul the power levers aft. That's all. There's no hesitation in securing reverse thrust. It's about like running into a brick wall. There's no doubt in your mind about deceleration for you feel as though you're heading for the windshield.

It's entirely possible to stop the airplane without ever touching the brakes. Getting right on the nosewheel steering insures positive directional control and by keeping the fans in reverse, the beast stops. It's normal procedure however, to come out of reverse when forward speed has been reduced down to about 40 knots and then use the brakes to finish the job.

Naturally, there are a few things that could be improved.

From the pilot's point of view, the transmitter selector for interphone or command position could be relocated onto the yoke instead of on the pedestal. As currently employed, the selector is awkward to reach and it is possible to forget to switch from command to interphone while working in traffic and thereby confuse the tower operators and leave your crew in the dark when they should be going through the pre-landing checks.

We are not particularly happy with the repositioning of the condition levers. The first models had the levers mounted on the forward, overhead panel where they were completely accessible but still out of the way. The latest configuration places them on the quadrant. Admittedly, they are handier for the pilots, but, we hate to see a nice, simple quadrant all cluttered up.

The plastic guard that protects the propeller synchronizer reset buttons could certainly be beefed up or redesigned of a stronger material and some of the spring-loaded safety guards on various toggle switches could stand heavier springs.

Easy to Fly

Perhaps we've made the C-130A sound like a complicated piece of machinery. In a sense, it is. There are many electric and electronic systems and there is no doubt that we are putting an ever-increasing load on the maintenance specialist. That, however, cannot be avoided if we hope to keep progressing. But, from the pilot's point of view, this airplane will prove itself to be an easy craft to fly and we predict that you'll like it. ●

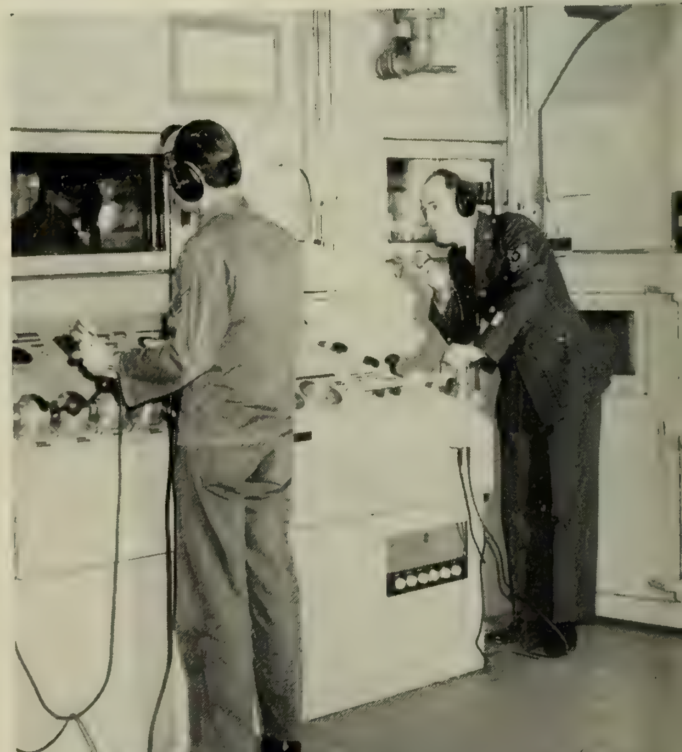
Keep Current

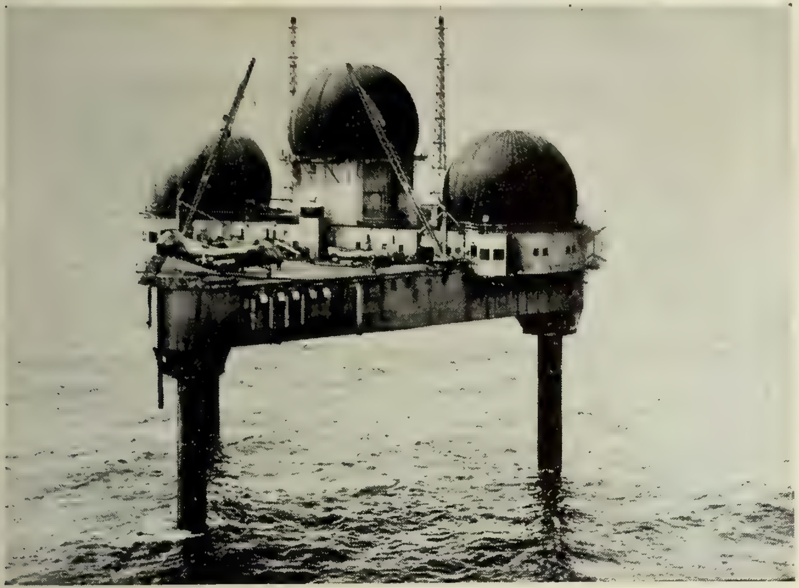
NEWS AND VIEWS

Above is B-52 performing air-to-air refueling mission with KC-135.

Using outrigger and rear landing gear as high-speed brakes, this B-47 Stratojet medium bomber is shown beginning a 6000 feet-per-minute descent from high altitude during a penetration mission.

Technicians work at control panel of new high altitude chamber.





H-21 helicopter makes two trips daily to Texas Tower early warning radar site.

Ever see a "flying tiger?" M/Sgt. "Satan" is mascot of 437th FIS.

Texas Towers Yet—An H-21 helicopter lands on the Texas Tower radar site, which is part of the early warning radar chain. The site is located approximately 100 miles offshore in the Atlantic Ocean. H-21 helicopters will soon be the sole transportation support for this site on a regular basis. They will make two trips a day, carrying loads of approximately 1550 pounds each trip. Personnel, supplies and equipment for the "man-made" island have first priority. During the winter months, the H-21s have been carrying all types of cargo while working out flight and navigational procedures.

The helicopters are equipped with specially designed emergency flotation gear for over-water flying.

★ ★ ★

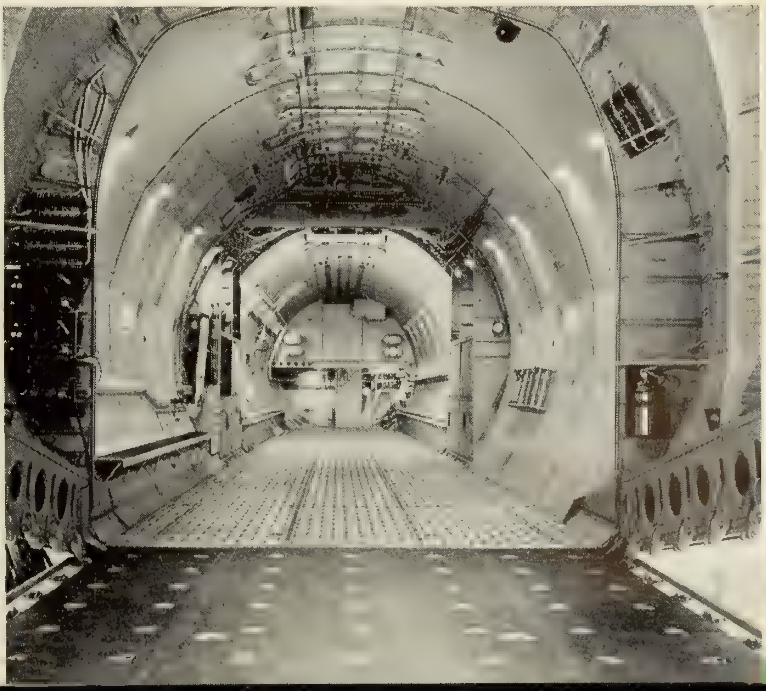
New Altitude Test Chamber—ARDC has a new test chamber that can simulate altitudes that are in excess of 150,000 feet.

The chamber will be used to study effects of very high altitude flight on men and to aid in designing protective equipment for Air Force personnel. Special pumps and valves make it possible to decompress the chamber as quickly as an airplane would decompress if its canopy were blown off. This is a condition that most other chambers can only approximate.

The new chamber is divided into six compartments. The largest, or main chamber, is used primarily for tests of instruments and systems at altitude and has a 7 x 8-foot door through which large and bulky equipment can be wheeled. Personnel and personal equipment are taken to high altitude in a training chamber, while off to one side of this smaller compartment is a one-man chamber which simulates a cockpit.

The sixth compartment is the animal chamber for experiments that might call for human volunteers. ●

Cargo section of C-133 can carry payloads twice capacity of C-124.



Sizzling STRIPS

SUMMERTIME . . . June, July, August and September . . . visions of gorgeous lovelies cavorting at the beach or languishing on the side of a swimming pool. Summertime . . . air-conditioned offices and khaki uniforms. Summertime . . . premature gear retractions on takeoff. Summertime . . . the season of the year when the combination of hot weather, hot runway temperatures and hot pilots team up to class 26 jet type aircraft during takeoff.

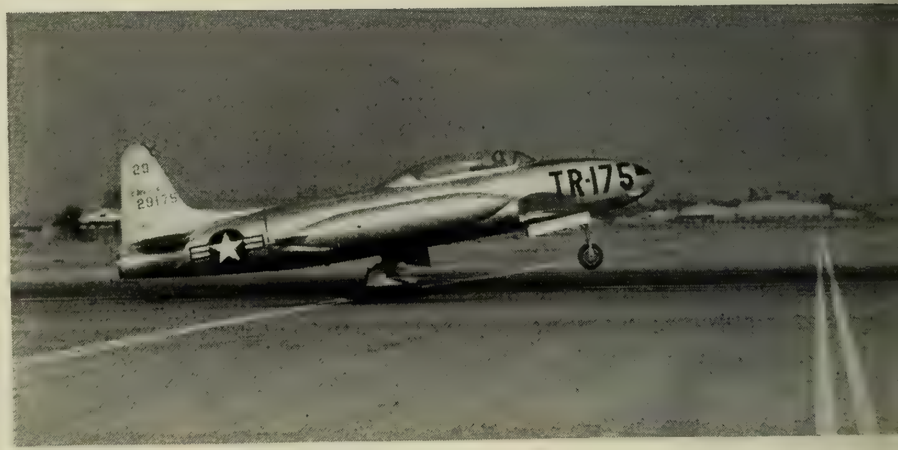
Here are some ways that this is done:

- Attempting to take off at too low an airspeed.
- Apprehension concerning length of runway remaining.
- Using a runway of insufficient length for takeoff.
- Improper calculation of required takeoff roll.

If you're a jet pilot, the above items are all familiar. However, premature retraction of gear on takeoff does happen. Why? Primarily from faulty pilot takeoff practices and techniques.

You, as a jet pilot, know what density altitude is and how to interpret it when computing your takeoff roll; you are familiar with the Dash One and how to use it in determining your "unstick" point on the runway; you are required by AFR 60-16 to record takeoff distance on the Form 175, and you should know how to use runway distance markers.

Nevertheless, if past trends reflect future accidents, there are going to be some premature gear retractions on takeoff by jet pilots this summer. While you are reading the following actual accident accounts, visualize yourself at the controls of the aircraft.



Would you fly the airplane like these pilots did?

You have two flights scheduled in one day. The first is early in the morning. You tool down the runway. That familiar intersection zips by. You take a final split-second glance at the airspeed indicator. The jet fairly leaps off the strip. You pull up on the gear handle and climb to altitude.

Second Flight

Second flight of the day. The sun is straight overhead. Runway temperature hovers around 100°F. You jot down the precomputed takeoff distance on your thigh pad. You climb into the too-hot-to-touch cockpit.

Down the runway that familiar intersection goes by. You take a final glance at the airspeed indicator. The jet skips off the rough runway. *But it isn't ready to fly yet.* Your fingers automatically close around the gear knob. You pull up. The aircraft settles back down on the runway. It skids to a crunching halt.

Invariably, the comments of the pilot to the investigation board sound like this: "I had a power failure. . . ." Yet, when the jet is hauled off to the base shops and the engine tested, it runs perfectly. 'Twon't work, bub, you've just prematurely retracted the landing gear.

Picture yourself in the position of the pilot who had the following accident. You probably have used a similar takeoff technique.

The heat waves shimmer off the runway. You firewall the throttle. Sluggishly the jet starts its roll. Finally, the airspeed indicator needle swings past nose unstick speed. You pull back on the stick a little. The nose comes off. Your eyes glance momentarily toward the far end of the runway. You can see the boundary fence and some telephone lines loom ahead. Unconsciously, you tug back on the stick a little more. Slowly the airspeed indicator moves up a few more knots. No rapid acceleration today. The end of the runway looks mighty close. You haul back forcefully on the stick.

Left is example of nose-high attitude during takeoff roll. On a very hot day the aircraft may never get off. Get sufficient airspeed working for you and then lift the nose slightly off the runway. Let it fly off. Above, you'll be flying hot and heavy, so let it roll 'til it's ready.

Why go on—you're on the back side of the power curve—you abort.

Here is one last clincher that might convince you that hot days and high runway temperatures demand your complete concentration and skill when taking off.

The pilot released the brakes and started the takeoff roll. At the approximate point where he should have become airborne, the pilot "horsed" the jet off the strip.

The aircraft flew for a short distance and then settled back on the runway. The pilot lowered the nose, then again "horsed" the jet back into the air, this time in an exceedingly nose-high attitude. Again the jet settled back on the runway.

Nose High Attitude

At this point, the pilot decided to abort. The aircraft bounced over the barrier and continued to roll down the overrun. The nose gear sheared when it struck some rough terrain but the aircraft kept skidding until it came to a stop about 4000 feet from the end of the runway.

What do these accidents indicate? That some pilots are continuing to maintain an extremely nose-high attitude during the takeoff roll and attempting to take off before flying speed is obtained.

How can you improve your takeoff technique? There is no magic remedy. However, you can abide by this well-established procedure:

Get sufficient airspeed working for you and then lift the nose slightly off the runway. Now, hold it there for a spell. Be content to let the beast build up some knots. If it starts to skip on you, repress that tendency to haul back on the control column and yank the gear handle up. Make sure the bird is ready to fly, then have at it.

On most jet aircraft there is about an eight-knot range difference between takeoff speed and stall speed during takeoff. Make sure that difference is working for you, not against you.

Take the T-33 for example. The Dash One states: "At about 85 knots apply back pressure on the stick and raise the nose of the aircraft until the nosewheel just clears the runway."

Many pilots, at this point, tend to pull the stick too far back with the result that the aircraft assumes this nose-high attitude. The takeoff run is thus greatly increased. On a very hot day the aircraft may never take off.

The T-33 has a tendency to bounce. ". . . It gets light on its feet" just prior to reaching flying speed. These bounces vary in intensity with the roughness of the runway. If not careful, you may believe that the aircraft has started to fly when in reality it is skipping between bounces. Jerk the gear up during one of these bounces and you may be through flying. Period.

Quick Refreshers

You know that the higher the temperature, the more runway you are going to use. You get into trouble when you try to make the aircraft fly before it is ready to do so.

For a quick refresher, here are some items you should remember about everyday summertime flying.

- There is a four to five per cent loss in thrust per 10°F. rise in ambient air temperature above sea level standard.
- There is a two to three per cent loss in thrust per 1000 feet elevation.
- The rated thrust of a jet engine is not your net thrust because of installation loss.
- The static measured installed thrust is not all available to you to accelerate with.
- Excess thrust is what is available above that being used at the moment to hold speed already attained.
- Excess thrust is the thrust that takes the big loss due to high ambient air temperature.

Check the figures below and you will see that they come close to your takeoff performance charts.

- For each 10°F. ambient air temperature above sea level standard of 60°F., increase your rolling distance by 10 per cent.
- For each 1000 feet elevation above sea level increase your rolling distance by 10 per cent.
- For clearing obstacles, convert obstacle height in feet to per cent. Add this to the takeoff distance. For example: A 25-foot obstacle increases takeoff distance 25 per cent.

You're going to be flying hot and heavy this summer. Like one Texas-based instructor said, "Making a jet takeoff is just like rolling your own cigarettes. You let 'em both roll 'til they're ready. ●

Drip Blip

Many a pilot has had to execute a missed approach because of lost radar contact. This article may help you anticipate and plan for that possibility.

I'VE BEEN flying in this man's Air Force for a good many years and I thought I knew most of the tricks of the trade. But, "you learn something new everyday."

My boss wanted me to take some cargo up to Martini Air Force Base. I arrived at base ops, met my copilot and proceeded to the weather station. We received a thorough briefing. Weather at Martini AFB on arrival was forecast to be 600 overcast, two miles visibility, intermittent rain showers reducing visibility to one mile. I said to myself, "Guess this will mean a radar approach."

After getting into the blue—correction, 'gray,' and while cruising on course, I started talking to Charlie, the copilot.

"What's your job, Charlie?"

"Air traffic controller, Joe. Just returned from Germany."

"ATC man, huh? Guess that's why you gave that position report so precisely, eh? Only thing, you didn't tell those boys our point of departure, route of flight and destination. How do you expect them to know where we're going?"

He answered, "You know, Joe, too many pilots are still stating all of that superfluous information. It doesn't help the ATC controllers at all. In fact, it hinders them. Frequency congestion is bad enough as it is. If pilots would follow the position report sequence as listed in the back of the Radio Facility Chart, everyone would be happy. ATC would have just what they need. And there wouldn't be so much radio congestion. So why waste your breath?"

We neared our destination, after flying for a couple of hours. Our clearance from Four Roses radio read, "Cleared to the Manhattan Range, to contact Martini Approach Control five minutes prior to reaching the Daiquiri beacon."

"Martini Approach Control, this is Air Force 46647—over."

"Air Force 46647, Martini Approach Control. You are cleared to the Manhattan Range; descend to and maintain 3000 feet. Martini weather, 1100 hours observation is 500 overcast, visibility one-half mile in rain showers, surface wind west 14 knots, altimeter 29.86. *Radar not available.* Base operations advises weather is below minimums; hold for improvement or proceed to your alternate."

"Roger, Martini Approach Control. Understand 46647 cleared to Manhattan Range at 3000 feet, leaving 5000 at 15. How long will this rain remain in the local area?"

"46647, weather advises moderate rain until 1145 changing to light showers until 1600."

"Roger, Martini Approach Control. We'll wait for improvement."

"Air Force 46647 when over Manhattan range, hold northeast, expect approach clearance at 1145."

The rain diminished to a light drizzle at 1130 and we made a precision radar approach. No sweat.

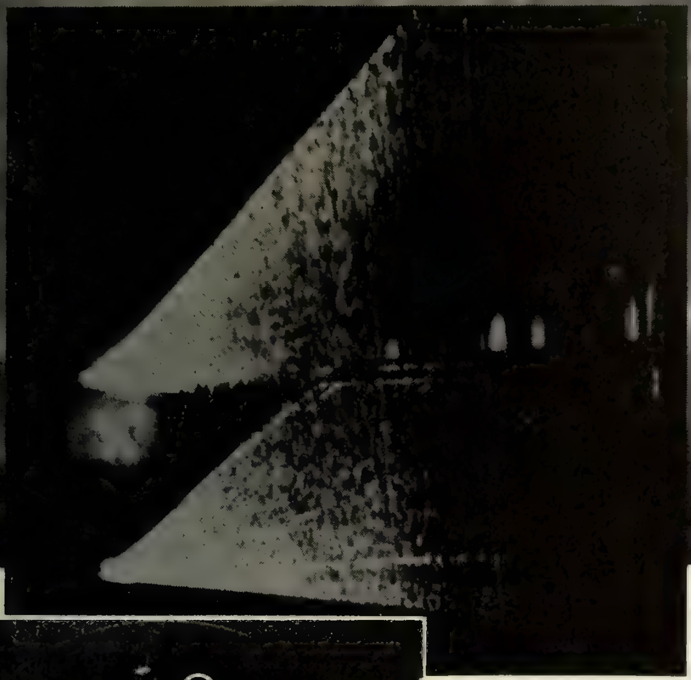
On the return trip we contacted Highball Approach Control for our clearance.

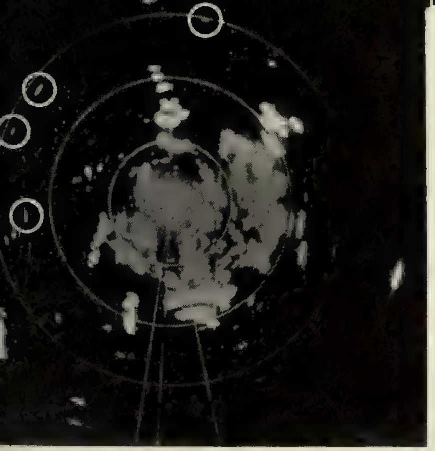
"Air Force 46647, this is Highball Approach Control. You are cleared for a precision approach, active runway 19. Highball weather—precipitation ceiling 300 feet, visibility one-half mile in heavy rain showers, surface wind south 8 knots, altimeter 30.14—over."

We "Rogered" and were instructed to contact the radar controller on channel 17.

After the flight was over I said to my copilot, "Charlie, I must admit that I'm a little confused. At Martini, where the rain wasn't nearly as bad as it is here at Highball, we had to hold for improvement in the weather. It's raining cats and dogs outside now, yet we were cleared to make an immediate approach. Since you're in the business, how come?"

He replied, "Joe, I suggest that we make a trip over to the RAPCON





Upper photo shows how heavy rain shower looks on radar scope not equipped with circular polarization grid. Notice circled dots, bottom left, and then center of scope. This is "rain clutter."

building. The difference is that here at Highball the radar set is equipped with a gadget known as 'Circular Polarization.' This practically eliminates rain clutter from the radar scope. I'll show you what I mean when we get to RAPCON."

Entering the semi-darkness of the radar room, we walked over to the far end of the room where the precision radar equipment is located. A controller was "bringing in" an aircraft on final approach through the heavy rain, with no difficulty.

He commenced, "Take a look at this precision scope. As you can see there is no intereference from the rain. This is because the precision equipment has circular polarization installed. If traffic permits, let me try to show you what this scope would look like without the circular polarization feature."

He tapped the controller on the shoulder, "Mac, how's your traffic load for the next few minutes?"

"Oh, I have about a 10-minute breather. Why?"

"Will you call the remote site and ask them to remove the screens for a few minutes?" he said.

"Okay." Mac flipped a key on the console and spoke to someone for a few minutes. Immediately, the precision scope presentation changed. It was practically a solid mass of white reflections. I saw why it would be impossible to track an aircraft through that stuff.

Charlie continued, "This is how a precision scope looks during heavy rain without circular polarization. The radar scope at Martini looked like this while we were holding and waiting for the rain to pass. See the surveillance scope now. Plenty of precipitation interference showing.

"Symmetrical objects, such as raindrops, are circular polarized, but with a reverse twist. We have discovered that by inserting some grids into the antenna radiation field, these reversed reflecting waves are rejected. Only those non-reversed waves (coming back from the aircraft) will be accepted by the antenna. Thus, no rain clutter will appear on the scope.

"Most of our precision radar sets are equipped with these grids. The precision radar is used for the final approach. It gives elevation as well as distance and direction from the runway.

"The surveillance radar set which is used by a controller to feed aircraft to the precision radar controller doesn't have this gimmick yet. It's coming, but until it's installed the surveillance controllers may have trouble seeing aircraft during heavy rain. When this occurs, the pilot may get that phrase '*radar not available*.' That's what happened to us."

I nodded, "Mighty interesting. This, then, is the reason why pilots who are flying in areas of heavy precipitation are advised that 'radar clutter' may make some types of radar equipment unreliable."

He summarized, "That's right. Remember I said that the surveillance radar equipment doesn't have this circular polarization gimmick yet. Usually, a pilot will be observed first on a surveillance scope. Then he will be turned over to the precision approach radar controller. Don't confuse circular polarization with MTI equipment (Moving Target Indicator) that is used on late model surveillance radar sets. The MTI picks up any *moving* target. Also, it eliminates most background reflections. Incidentally, the May issue of FLYING SAFETY has an article on types of radar approaches and equipment in the story 'All the Way?' "

"Thanks, Charlie. See you later." ●

ROUND AND ROUND YOU GO

Types of radar approaches and GCA phraseology were featured in the article, "All The Way?", Flying Safety, *May, 1956. Since then, new terminology regarding the type of landing approach (straight-in or circling) has been incorporated by AACS operating personnel. The object is to tell the pilot, as soon as possible, the type of landing pattern he will be cleared to make. Here is how one lad got the word.*

HOLDING NORTH of the range station in a standard holding pattern at 25,000 feet, Captain Little looked down and saw the two other jets below him flying their respective orbits. They, too, were awaiting penetration clearances.

Two minutes later, the first of the two orbiting jets was told to switch to channel 15. Anticipating similar penetration instructions, Captain Little switched channels to listen to the controller.

"Air Force jet 35974—Ceiling 800 feet, visibility five miles. Wind south at 15 knots, altimeter setting 30.06. You are cleared for a jet ADF approach, runway 35. Upon reaching 500 feet (circling minimum altitude) you are cleared for circling approach to runway 17."

Captain Little glanced at his letdown book. He noted the flight path the descending pilot should make good. At the bottom of the page he also noticed the published minimum altitude for a circular approach. In this case it was a little higher than that given for a straight-in. This was the first time he had ever heard a controller give the type of landing approach along with the clearance for descent.

He thought, "Hmmmm. . . . To clue the pilot in on the type of landing approach before even breaking out, is good stuff. It gives him a chance to plan his landing pattern. It used to be that you had to switch over to the tower after you became VFR."

He heard the second jet receive similar penetration and approach clearances.

Ten minutes later, after his own penetration, he relaxed at the base operations counter.

"What's this new deal on giving circling approaches?" he asked.

Having had several such questions recently, the Clearance Officer was ready with the answers—almost a lecture. He started with basic reasons.

"Pilots flying high speed jet aircraft in instrument weather should never have to change frequency for landing clearance. When making other than a straight-in approach for landing (except radar approaches) they will be issued a clearance some time before they report over the low cone. Something like: 'Upon reaching (circling minimum altitude) feet, cleared for circling approach to runway (number).'

"However, it could happen that you would receive clearance for a circular approach before starting your letdown without receiving actual clearance to land. In that case, they will tell you when to expect landing clearance. For example, they might say, 'Cleared for a standard ADF letdown. Upon reaching 500 feet, you are cleared for a circling approach to runway 34. Expect landing clearance (a) at three miles, (b) when over the range, or (c) when the field is in sight.' "

"Well, what about an aircraft making a radar approach?" Captain Little questioned.

"Aircraft making a radar approach to other than the landing runway will be given a litte bit different deal. They'll say, 'This precision (or surveillance) approach is being made to runway 5. Upon reaching 500 feet, you are cleared for circling approach to runway 34.'

"Normally," he continued, "they'll get the landing clearance from the tower and relay it to you at the same time the circling approach clearance is issued.

"Of course, if you're making an approach to one runway and they want you to land on another, they will tell you when you reach your circling minimum altitude. You should not descend any lower. If they do see you going lower, they'll remind you. If they've got you lined up on a runway other than the GCA runway (where they have the elevation scope), they won't know your altitude, and will tell you, 'You should be at 500 feet, circling minimum altitude, report field in sight.'

"If you don't report the field in sight within one mile from the end of the runway, they'll give you a wave-off."

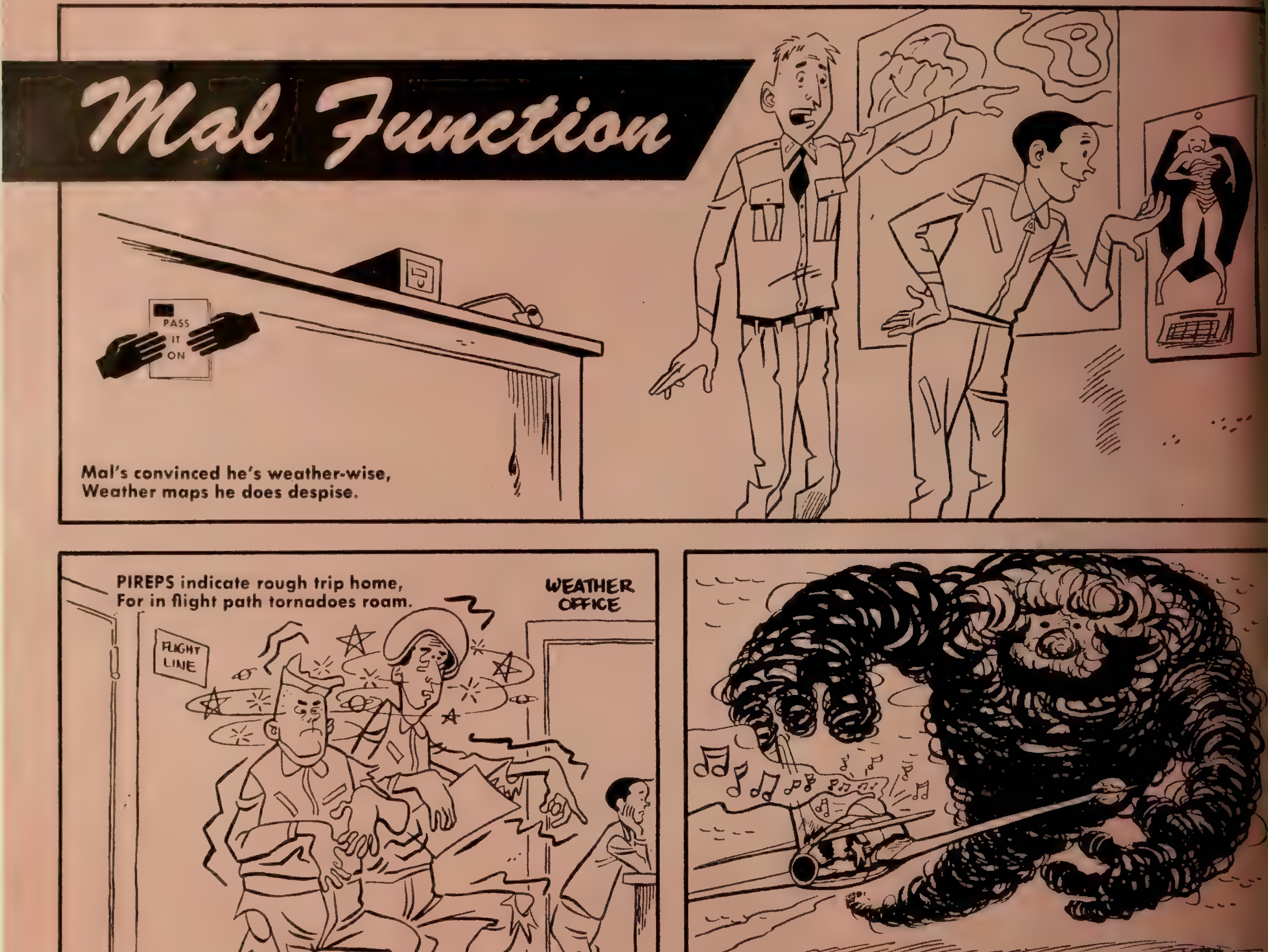
The jet pilot nodded as he flipped his unfolded Form 175 to the dispatcher.

"I'm glad AACS has come out with this. This way there's no reason why any pilot should mistake the runway he's supposed to land on or what type of landing approach he is supposed to use. All he has to do is listen to his clearance."

"That's right, Captain," came the reply. "All you have to do is listen." ●

FLYING SAFETY has it on pretty good authority that, next to the cover, this page seems to attract the most attention. Just why, we don't know but we are going to take advantage of the pulling power of this page to call your attention to the quiz on page one. Light the candle of knowledge and see if you can come up with the correct answers.

Mal Function


PASS IT ON
Mal's convinced he's weather-wise,
Weather maps he does despise.
PIREPS indicate rough trip home,
For in flight path tornadoes roam.
WEATHER OFFICE
FLIGHT LINE
Earphones bounce to "Love in Bloom."
While up ahead twisters loom.
Rain and hail has our pal jumping,
Storm excels at job of thumping.
Aircraft looks like broken crate,
As Mal takes off for Pearly Gate.

*U. S. GOVERNMENT PRINTING OFFICE . . . 362335

624.1305
FLYS

FLYING SAFETY

UNITED STATES AIR FORCE

JULY 1956

THE LIBRARY OF THE
JUL 17 1956
UNIVERSITY OF ILLINOIS

It Happened One Night • Survivalry...the art of.

FLYING SAFETY

VOL. TWELVE NO. SEVEN

- Learn from the experiences of others. "Survivalry . . . the art of" gives you a first-hand account of how to survive at sea.
- Have you ever flown into the wake of another aircraft? The facts in the article on page 22 may convince you to stay out of this turbulent area.
- The Sarge gets in a good lick in his letter which appears on page 28. Are you guilty?
- The MAINTENANCE REVIEW this month has an interesting article dealing with proper diet for aircrews. Get a copy and give it the once over.

Flying high, wide and fast is the B-66 which will be featured in August issue.

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major Jesse F. Townshend, Jr.

Associate Editor
Major V. R. Stutts

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby
T/Sgt. Chester McCubbin
T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune
A/2C Al Fagerwick
T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

Crossfeed . . . 1
It Happened One Night . . . 2
Survivalry—the Art of . . . 6
Well Done . . . 11
The Voice From Below . . . 12
Not Recommended . . . 14
Same Book—New Look . . . 16
Self Service WX . . . 21
Shake, Rattle and Roll . . . 22
Help! . . . 24
Rex Says . . . 26
See You Tomorrow, Sarge! . . . 28

★ ★ ★

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, July 6, 1954. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

LETTERS TO THE EDITOR

Near Misses

I used to enjoy night flying; in fact, having spent $5\frac{1}{2}$ years as a night fighter pilot, I actually preferred to fly at night, but no more. Why not? In allowing night VFR clearance with today's air traffic, and the widely varying speeds of today's aircraft, we are condoning a condition which only through sheer chance has not resulted in more aircraft fatalities than all other flight situations combined. Within a period of two months and only seven flights, I have experienced three near misses at night and yet no violation of flight rules was involved with the possible exception of that "T" model phrase about a pilot's responsibility to visually clear himself while flying VFR.

It is obvious, I think, that even though I may prefer to file IFR since I just don't believe that night and VFR are compatible, unless everyone else along my route also files IFR no one is protected. My purpose in writing this is not primarily to convince pilots of what they already know, i.e., that it is not possible to safely clear yourself at night; that whether the wing between a red and green light belongs to a C-47 or an F-86 cannot be readily ascertained although ascertaining it for safety purposes is pretty important; that you cannot safely fly VFR at night in mountainous terrain; that even though you can see every light in Los Angeles, the reflection in the haze layer of those same lights renders it impossible to see the clearance lights of other aircraft. All of these examples, I believe, have been experienced by the majority of pilots and yet we continue to tolerate VFR night flying against all rules of good judgment and safety.

I know that CAA facilities or personnel are not sufficient to handle all night traffic on an IFR basis now, or in the near future, but I certainly feel that they should be given that capability in men and equipment as soon as possible. As a further safety feature, I believe that all aircraft should be equipped with a proximity warning device similar to the "tail warning" with which many World War II aircraft were equipped.

Major Ralph A. Secor
Hqs Air Defense Command
Ent AFB, Colorado

Major, we're with you. Night VFR just ain't.

★ ★ ★

Get 'Em Down

Recently I've been led to believe that the Air Force has possibly revised its policy regarding crash landing procedures, in the event of landing gear malfunction.

I was taught that if only one or two gears would extend, it was best to retract all of the gears and "belly it in." However, in recent conversations with newly graduated pilots, I've been told that the best procedure, and the one presently being taught in the cadet program, is to extend all landing gears possible and land, keeping opposite wing up as long as possible. The persons who told me of this procedure were unable to explain the reasons therefor.

It has occurred to me that possibly it has been determined that the deceleration which takes place before the wingtip touches the ground compensates for groundloop tendencies. Or, possibly this is merely due to the difference of conventional and tricycle landing gear.

Can you furnish me with any information along these lines? I realize that the tech orders tell *what* to do but they don't say *why*. I'm interested in both runway and sod landings.

Capt. M. J. Mason
3337th Tech Trng Sq
Scott AFB, Illinois

Suggest you see the article, "Down Boy, Down!", in the February issue of FLYING SAFETY for jet fighter forced landings on unprepared surfaces. Also, for partial gear configuration, analysis of accidents revealed lateral deviation from landing path is not excessive and there is less risk of post impact fire and in general, less damage to the aircraft.

★ ★ ★

"Well Done" Award

I have a request concerning the "Well Done" award featured in FLYING SAFETY. Few people, to my knowledge, have positive, direct knowledge of the proper way of recommending a pilot for this honor. Would you please notify me if an AF regulation covers the procedure? It might be worthwhile to spell out the correct procedure in a future edition of your magazine.

1st Lt Larry J. Larsen
FSO 2233d ARTC Mitchel AFB.

Present procedures established by the Directorate of Flight Safety Research require that recommendations for the "Well Done" award be submitted through the appropriate major command. From time to time, nominations have been received from individuals and isolated units. This necessitates returning the report for resubmission through command channels.

In our daily lives we put great emphasis on practical wisdom. We place our trust in those we say are skilled—the experienced pilot, the experienced seaman, the experienced leader. Abbreviating "experienced" to "expert" provides a shortcut which always hides the fact that expertness comes only through experience and training.

This is especially true in survival where every man must be able to handle himself effectively. Each man has to be an expert. But—how can he gain expertness in a situation that everyone earnestly wishes to avoid—but which no one can guarantee will not come.

Probably the best method is to study survival experiences. Mistakes and successes reported by survivors are lessons which will help each man to be his own expert.

The publication "Airman Against The Sea" (published by the Arctic, Desert, Tropic Information Center, 1955) is based largely on a study of hundreds of survival narratives.

Few Air Force personnel realize that almost all personal and survival equipment developed from 1943 to 1946 was subjected to realistic testing at the Air Proving Ground Command. As a member of the unit which was charged with this responsibility, Dr. George A. Llano, the author of FLYING SAFETY's co-feature beginning on page 6, vividly recalls the vexing questions which plagued efforts to improve various types of sea survival equipment. At that time, he and his co-workers lacked complete understanding because they were unable to examine the official survival accounts which contained the very facts which their own testing methods were unable to reproduce.

For the most part, the words above are those of Dr. Llano. Your Editors have chosen to use this portion of the original story as an introduction to the two feature articles that appear in this issue. The first being, as Dr. Llano suggests, a long overdue account of an actual survival experience. As they say, "Only the names have been changed—."

Dr. Llano's article contains the latest word on many aspects of survival. The inescapable moral of both pieces is that in order to survive, you must know how.

WE ARRIVED at the base at approximately 1500 hours where we were supposed to pick up a C-119 and ferry it to an overseas base. The aircraft was not quite ready so we laid over until the next morning. By 1000 hours we had bought the '119 and went out to check over the emergency equipment.

We had to wait for our loose equipment to be brought out. That gave us a real good chance to look over the emergency gear. Actually, there is not too much that you can check on a dinghy or an exposure suit, but we looked them over as best we could. We checked the Mae Wests to see if the flashlights operated properly, that the oral valves worked, that there were no leaks and that all of the extra equipment was attached. A truck brought out the loose equipment which included the Very pistol, flares, first aid kits and headsets. I had the crew put the first aid kits around the plane and take the Very pistol and flares up front, while I checked over the headsets.

My engineer looked over the aircraft. He checked the prop oil and the data on the Form 781 that had been worked on. He talked to the flight test man in charge of the aircraft and was told that the plane had been flown about 10 hours since the prop regulator had been changed. According to him, it was a good flying aircraft. The engineer checked it over and everything seemed to be OK.

Our engine runup was normal and the aircraft checked out. There was no abnormal indication on the props so we leaped off at 2045Z.

Trouble

About seven hours and 15 minutes after takeoff, our trouble started. It was night—and a black one. The left tachometer began moving up slowly. The engineer came back on the prop control and that seemed to get things under control again. I called my radio operator immediately to tell him to get our position from the navigator and to call Hickam. I wanted him to tell them we were experiencing trouble and for them to alert Air Rescue Service. I did not declare an emergency at this time.

When I finished the call, the engineer told me the prop control was all the way back to the low stop and the prop had stabilized at 2450 rpm. I had the engineer check visually for a prop oil leak but there was none. We discussed the possible causes for a few minutes during which the engineer stated that the prop control felt loose and he believed the prop linkage was broken.

....it

I told the radio operator, who was still making his call to Hickam, to declare an emergency and request an immediate rescue intercept.

After the call, I sent the radio operator, the engineer and the navigator back to prepare for possible bailout. They had their chutes and dinghies back in the cargo compartment. They got them on and checked each other to make sure everything was okay. Then they came back up front. Meanwhile, the copilot and I got into our parachute and Mae West.

About 12 minutes after the prop stabilized at 2450, it started up again. I had briefed the crew that in the event the prop increased again, the engineer was to feather when I called for it; the copilot was to set up the right engine for single engine operation, and I would fly the aircraft. As the prop RPM started increasing again, I put the aircraft into a climb

happened one night!

"I radioed that we were abandoning the aircraft. I put the plane on autopilot. I rang the bailout bell."

and came back on the throttle to slow it down a little. It was going up a lot faster than before.

Then she really went. I guess it was hitting 2700, probably 2800 rpm when I called for feathering. I don't believe the feathering action even slowed it down. The RPM kept increasing to about 3100 rpm, oscillating 150 rpm on either side.

At that time, we started losing altitude, approximately 600 feet per minute. I trimmed it as best I could. I thought at first I wasn't going to be able to trim it all out. I told the engineer to shut the left engine down and see if we could freeze it.

I was hesitant in doing this as I did not know which way that prop would go, if it came off. And if the tip came off and the engine was pulled off its mounts, I didn't know if I could hold the aircraft or not. But it was a last resort procedure and I tried it.

About four minutes after we pulled the fuel-oil-hydraulic shut-off valve, we heard a loud noise. I can't describe it now, but we all heard it. At that time the tachometer hit 3500 rpm and went out. She really wound up! We figured that the engine had frozen and the prop reduction gears had sheared and the prop was spinning free. We were worried.

The worst thing I could imagine was that the prop would come off and cut through that '119 like butter.

I told the copilot to open the forward bailout hatch and to send the rest of the crew to the rear. I was really worried about what that prop was going to do if it did come off. I surely didn't want to get caught with all five of us on the flight deck. With them in the back, they could at least get out of the plane.

I tried to level off but I couldn't get it below 150 feet per minute descent. At 1500 feet indicated, and about 35 minutes after we first experienced trouble, I radioed that we were abandoning the aircraft. I put the plane on the autopilot and in a turn to the left. Then I rang the bell and told the copilot to bailout.

He looked back as if to say, "Is this trip really necessary?", and started moving. He got down on his chest by the bailout hatch and worked his head and shoulders down through the hold. The hatch is about five or six feet deep, and he worked himself down to about his waist and let go.

He fell through very cleanly and waited to open his chute until he was clear of the prop wash. When his chute opened he was on his back, head slightly down.

The crew in the back didn't waste any time either. They had opened up the right rear door and were all set to go. They had taken the six-man life raft and set it in the door ready to be kicked out. When the bell rang, the engineer kicked out the raft, and the navigator went out after it. The radio operator went up to the door and got pretty panicky. The engineer shoved him out and went right behind him .

Hard Way

Me, I had to do it the hard way Instead of going the way the copilot had, I knelt down and tried to make myself go head first. Every time I'd start, I'd grab hold of something. After this happened about three times, I finally just wrapped my arms around me and went out.

I felt myself spinning through the air. Five or six seconds later, I had stopped spinning and was on my back. At this time, I pulled the ripcord. I think I had about 40 seconds before I hit the water.

The engineer was in for a surprise On the way down, he unfastened his chest strap on the chute and one leg strap. He was just getting ready to unfasten the other one when he hit the water. After hitting the water (where there was about a 30-knot wind), the chute stayed approximately six feet off the water, dragging him

along. He had quite a time getting the other leg strap off, although it didn't take him too long. When he did, he took his dinghy loose from the harness straps and inflated one side of his Mae West.

The waves were pretty high, and they were going over his head all the time and getting water in his nose, mouth and eyes. Finally he got his dinghy out, got it all laid out for inflating, and *it didn't work!* The air started going out right away. He reached over to where the valve was supposed to be and there wasn't anything but a hole. He threw the raft away and inflated the other side of his Mae West.

The Mae West holds you pretty low in the water and the waves kept flipping him over on his face and submerging him. This happened about every ten seconds, and every few minutes he'd get a mouth full of water which made him vomit.

He was out there about five hours, I guess. Air Rescue planes were over us within three or four hours, I think. They spotted our lights. His flashlight worked real good, and they dropped a flare not too far from him. He figured that they knew where he was, if they could just get to him.

It wasn't too long after that that the USS Plymouth Rock came up. They pulled up and missed him on the first pass, then made another. This time they were able to pull him out of the water.

I guess my copilot didn't do much better than the rest of us. His chute started dragging him over the water too. He didn't have time to release any of his harness fasteners on the way down. So when he started being carried over the water, he went for his quick release mechanism. He fumbled with it for a little while. Like a lot of us, he wasn't sure just exactly how it worked.

He went back to the harness fasteners, but they were too tight and he couldn't release them. At that time he grabbed his parachute shrouds, hoping to spill the chute. He was almost successful in doing that. But just as the chute was starting to spill, he got over-confident, released it, and he was off again.

Quick Release

Then he went back to his quick release mechanism. He got them to work this time. The chute left him instantly. He got out of his harness and inflated his Mae West. They say to inflate only one side of your Mae West, but none of us found that one was enough. We had to inflate both sides. Maybe it was because the seas were too rough, I don't know.

His dinghy worked nicely and he climbed into it without any trouble. He pulled in the survival kit and got out the flares and what other things he could see in the darkness. He wasn't quite sure what was in there. He looked for the flashlight that had been attached to his Mae West. It wasn't there. That was a rough break for him, for two of the fellows were rescued right away because they used theirs to signal.

When rescue planes would come over, he would use his flares. The pilots saw the flares but they would lose his position since the flares would last for only about 30 seconds. Because of that and the fact that he had lost his flashlight, he spent the entire night in the ocean.

The water was pretty warm which was very helpful. He filled the raft with four or five inches of water just to keep warm. He managed to stay in the raft all right—except once. He was waving a flare at the ship. He got a little excited and fell out of the raft. But he got back in and sat down and behaved himself.

Shortly after daybreak, he was spotted by the USS Plymouth Rock. They turned back around to get me since I had only a Mae West. In doing so, they lost sight of the copilot momentarily. A B-29 spotted him again, and directed the ship toward him. The B-29 came down to about 200 feet and dropped smoke markers around him. Then the ship's crew saw him and went churning over.

He had no idea of how they were going to pull him aboard. They threw him a lifesaver with a rope attached. He caught it all right, and they played him along the side of the ship, back to the rope ladder. There were two or three fellows hanging on the nets and one grabbed him as he went by. One of them yanked on him but lost his grip, and he, too, ended up in the water. He didn't have a Mae West on and he was scared. I can see why because the seas were really heaving up and down along the side of that ship. He did have a line around his waist, which was attached to the ship, so they pulled both of them back to the rope net and they grabbed hold of it. They got a rope tied around the copilot then, and pulled him aboard.

". . . the dinghy worked nicely and he climbed into it without any trouble. The water was warm."

". . . we had a lot of recommendations we've passed on. Most important to know how to swim."

Here's the ringer. Me again. On the way down after my bailout, my first reaction was to go to my quick release. The second reaction was that I didn't remember exactly how it worked. I couldn't remember if there were just two movements in the operation, or whether the first operation was a movement up or down. I decided I just wouldn't fool with it. I didn't remember just how it worked and thought the best thing to do was to go for the harness. I unfastened my chest strap and my left leg strap, and was working on the right leg strap when I hit the water.

Actually, when entering the water, none of us had the feeling of going down very deep at all. I went in the water very calmly. I kept my left hand underneath my right harness as I inflated one side of my Mae West with my right. I was playing it real nice and cool.

Boy, about that time, I felt like someone hooked me on to a fast moving freight. I was jerked clear out of the water. My chute literally ripped off my chest. The next thing I knew, I was ricocheting across the water at a terrific pace. My right ankle was still caught in the harness strap! The lanyard from my dinghy, which I had fastened on my Mae West, had ripped the ring right off.

I was flipped over on my stomach and the water was being forced up my nose. When I would break through a high wave, I would be completely submerged for a period of five to ten seconds. I don't believe I ever came closer to drowning!

A strap from my harness was dragging by my side. I grabbed it and tried to pull myself up so I could get the strap loose from my ankle. Every time I did that, a gust would hit the chute and throw me right back. I'd roll on my stomach and have to fight to get on my back again. One time I tried to bring my left foot over to my right and kick my shoe off. But that ended me up on my stomach again.

After about four such tries, to be very truthful, I just gave up. I was weak. I felt that if I were flipped over on my stomach just one more time, I'd never be able to get on my back again. I don't remember what happened next. I don't remember how long that went on, or when the chute left me. The next thing I do remember is floating in the water. The chute was gone; my right shoe was off, and my ankle was awfully sore. I guess the strap finally just pulled my shoe off and left. As soon as I realized I was free, I really felt good.

I started to sober up then. I realized that I didn't have a dinghy and that I had about 11 hours to go, before it got light. Actually, my first thoughts were that it was too far for a helicopter to come and an SA-16 wouldn't stand a chance landing in that water.

Stay Alive

All I could think of was that it wouldn't be until next morning before they could rescue us. That is—assuming that they could find us and the wind calmed down. I never dreamed there was a surface vessel so close.

The big problem was to stay alive until morning. That began to look like no easy problem. The water was constantly washing into my mouth and nose. When I would swallow a lot of salt water, it would make me sick, and up it would come. The vomiting made me feel better, but it would also make me weak. I tried to conserve my strength by putting my head back, my arms out and letting my legs drag. It never did work. A wave would completely wash over me. Or it would slap me down head first and I'd have to fight to get my head out of the water again. Pretty soon, it got so I was hesitant to let my legs and arms stop at all. With them moving, I seemed better prepared to keep myself from being submerged by the water.

I never had an aircraft actually fly over me, although I could see and hear them. When the USS Plymouth Rock came on the scene, it was hours before I was sure that it was a surface vessel. They turned on all of their lights and all of us spotted them. Fortunately, our last position report had been accurate. It was a good feeling to see that ship out there. My morale really went up!

I tried moving toward the ship. It was actually a futile attempt in that water. But, although the ship was visible only a quarter of the time, I seemed to be submerged less and my morale was higher. I guess with a goal in mind, I had less time to think about my troubles.

The next thing I knew, I was on top of a swell. A floodlight came around and landed on me, swept by me and then came back. It stopped on me! I started waving and yelling. Not that it did any good—they had seen me already but certainly could not have heard me.

The ship came alongside of me and then there was someone in the water holding me. We were being pulled toward the ship. The first thing my hands touched was a rope ladder hanging over the side of the ship. What a wonderful feeling to put my hands on that net!

To sum it all up, we were real lucky. Having circumstances turn out for you the way they did for us is almost unbelievable. There has been a lot of talk about this "Miracle Rescue." But although we made our mistakes, most of us are alive today because we did not panic and of course we had a little luck going for us.

We had a lot of recommendations that we've passed on, but the most important one is "know how to swim!" In water like we were in, a guy who didn't know how to swim well would be in a bad way.

The Old Man had a comment I'll never forget. He said: "You'd all better stay away from high bar stools. I don't want you falling off any of them. We'll give you credit for a week's PT for all that swimming. And, by the way—we're mighty glad to have you back!" ●

Survivalry...the art of

Dr. George A. Llano, ADTIC, Maxwell AFB, Alabama.

WHEREVER aircrews gather, the conversation sooner or later will turn to some phase of survival, and never more so than when preparing for overwater flights.

Although the acts and techniques of survival and the value attached to survival gear are all wide-open subjects for every wandering opinion, the art of surviving cannot be learned by talk. You either learn it by practice and conscious effort or you don't. Few who've outlived their hardships at sea can recount their successes without some apology for lessons which they failed to heed or for equipment which they failed to use properly. This art of surviving I choose to call "survivalry."

The Air Force has regulations pertaining to survival which are intended to provide for survival training and for personal equipment programs. This training and these programs are expected to keep aircrews proficient and ready in the event of an emergency of any kind.

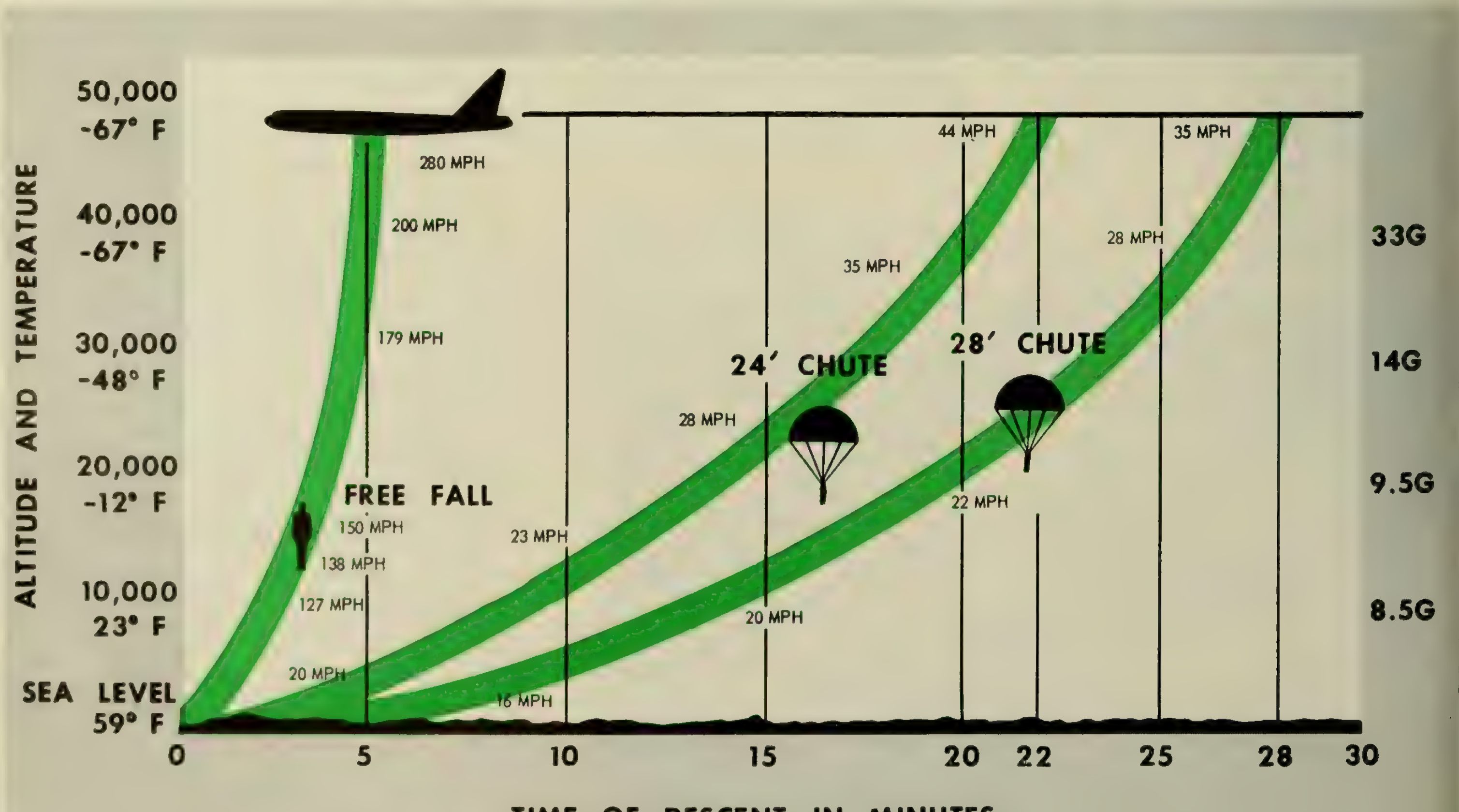
The Air Force Dictionary, scheduled to appear soon, defines "survival" in the following manner: "The primitive act or state of continuing to live, especially by the preservation of one's life against any immediate peril, such as drowning, starvation, dehydration, oxygen deficiency, heat, cold, low atmospheric pressure, bacteria or radioactivity."

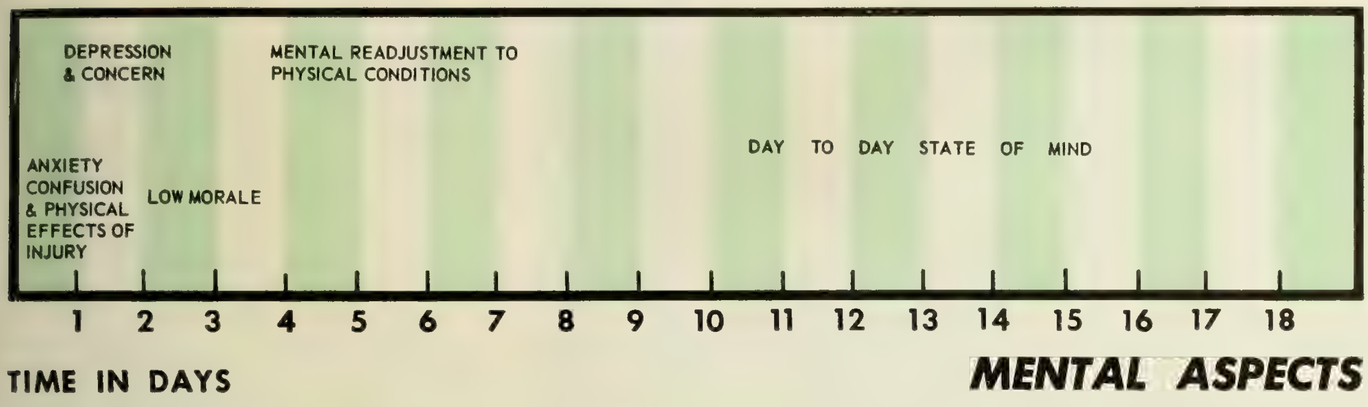
This definition deserves more than casual attention because in its parts the high points of "survivalry" are clearly spelled out. An individual's first reaction to an emergency is always a natural effort for self-preservation, and every man's actions are excited by his desire to live. With training, these primitive instincts can be disciplined into orderly procedures. When the emergency takes place over water, the sequence of events moves rapidly into critical phases that are, to a greater or lesser extent, the test that separates the disciplined from the undisciplined.

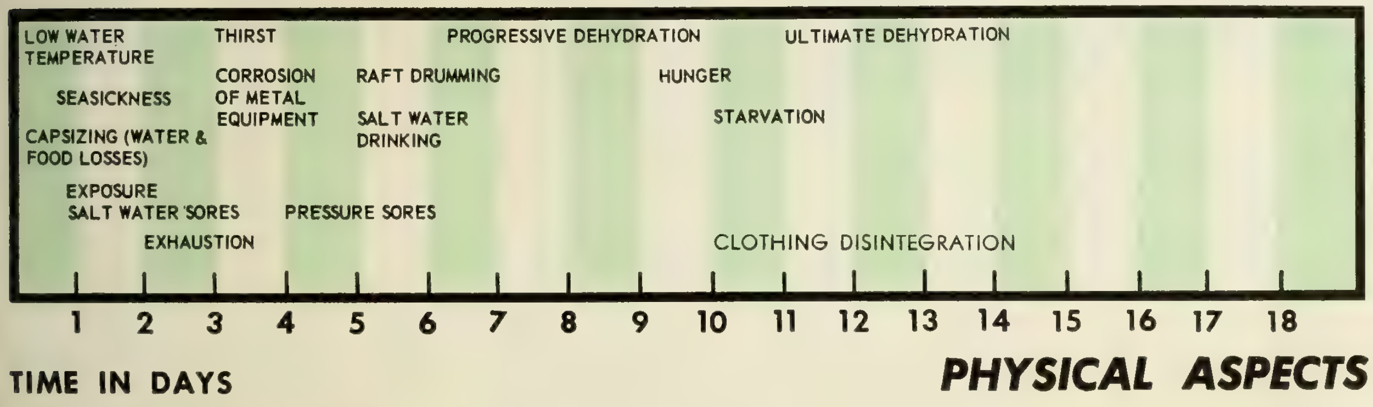
A wit once remarked that experience is the name everyone gives to his mistakes. But fortunately, in "survivalry," mistakes are often rewarding when they provide gainful experience in learning, that is if the error does not end in misfortune. So, consider the errors of your predecessors and thus profit from a rich background of personal experiences with which to meet future eventualities. For those who remain ignorant in spite of experience or training, there is only one hope—luck. Of those who relied on such a fickle fortune, only a few filled out a survival form.

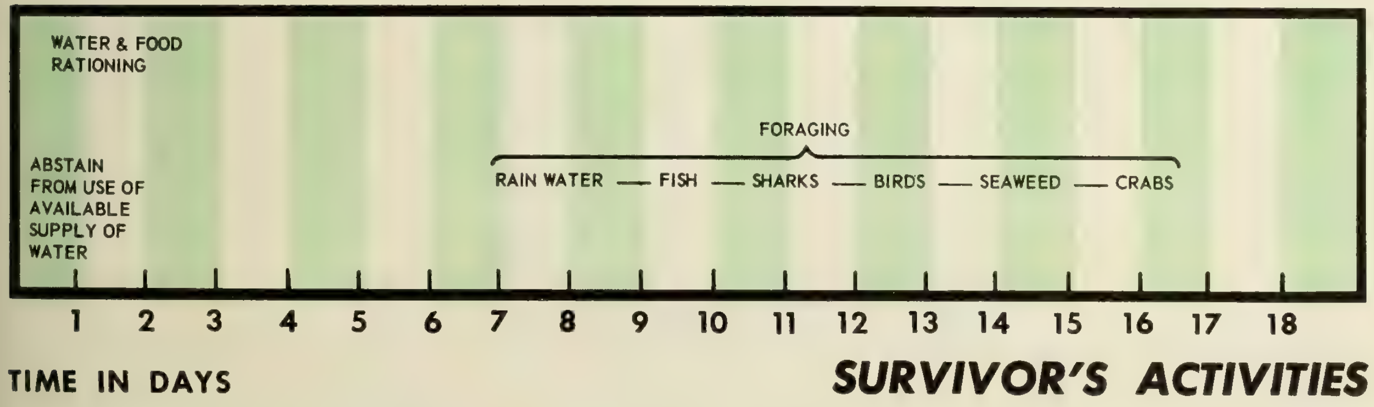
Thus, in line with our theme on the value of experience and with our concern for those who go down over the sea, it seems appropriate to repeat the words of a survivor rescued after three days on the Adriatic Sea: "And

Value of free fall. These are calculated rates of descent for free fall and open parachutes from 50,000 feet for man of 200 lbs.









What happens to you when you are down at sea? Check time in days in relation to phrases in charts above.

last but not least, every man should be exposed to a wide variety of true accountings of actual ditchings. This latter phase (of training) is the one that I believe is likely to be omitted." Would you agree with this statement?

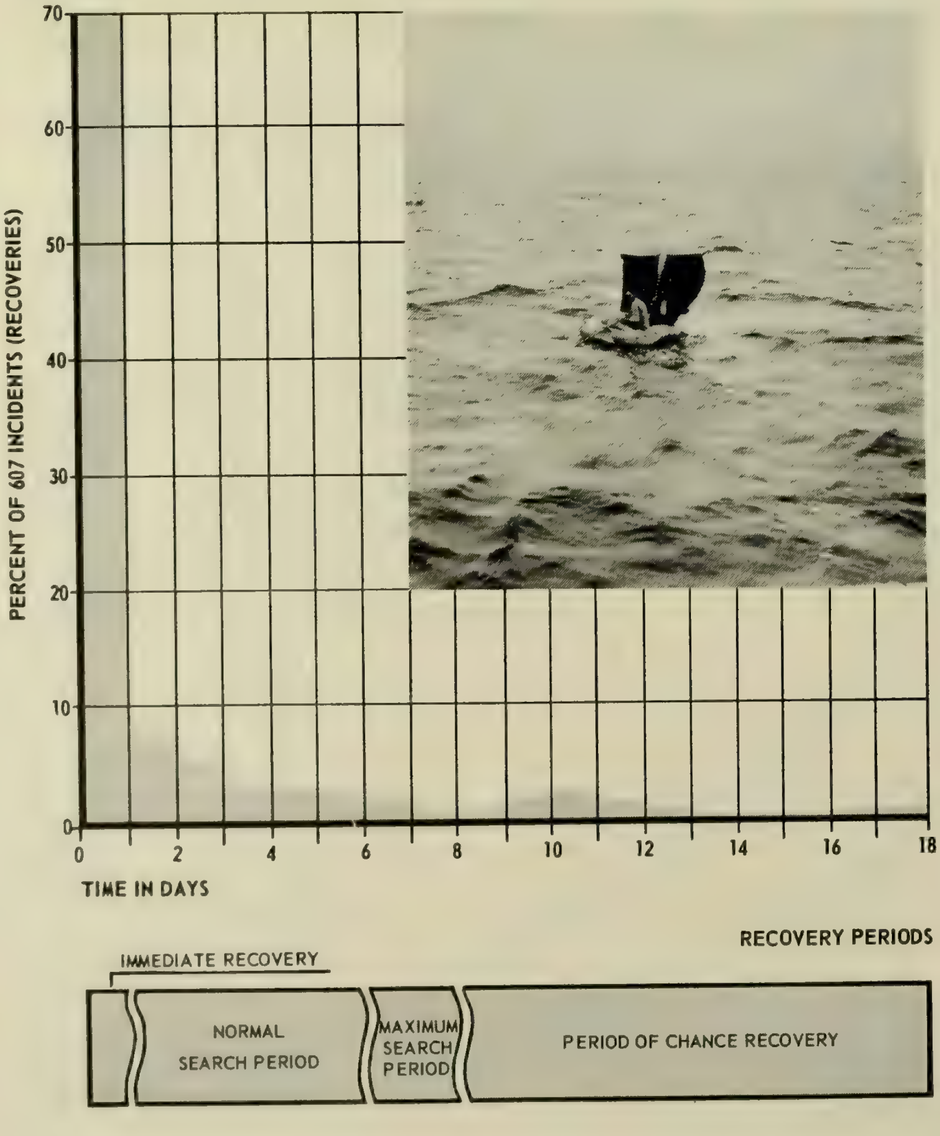
Has the Picture Changed?

During World War II, survival equipment and training in survival methods mushroomed in many directions. The need was great, and in the absence of experience many ideas were tried which are now judged less useful. The late General H. H. Arnold refers very effectively to some of the problems of his day in the book, "Global Mission."

For the most part, briefing and training on water survival was not too good; men did not know their equipment or how to use it. Emergency equipment was meager or often in no condition to be used. The most favorable part of the survival picture was that through skillful ditching it was possible to get down on the sea safely. Consequently, aircrews held the advantage of starting a survival with all their necessary sea gear. However, human nature being what it is, the probability of human error will always be a critical factor in determining the final outcome of a survival at sea. Certainly, the same difficulties in operating survival equipment were revealed during the Korean War which were so manifest in World War II narratives. In addition,

Be familiar with your personal and survival equipment—in detail. Test your own proficiency.

Charts below show recovery periods in relation to time in days. Life raft is essential item.



the problem of survival is beset by many implicating influences. Aircraft design is becoming more radical and that effect is fully reflected in the more severe demands made on personal equipment. Survival equipment requirements necessary to match a concept of global strategy that cuts across sharply contrasting temperature zones in a matter of hours must eventually settle on the basic environmental needs of man. For irrespective of our mechanical progress, man and the elements are always the same. Since time immemorial a man alone against the sea has had no choice but to fight for existence and to contend with the physical and mental afflictions of heat, cold, hunger, thirst and utter loneliness.

If at high altitude, high speed jet aircraft do not show characteristics for favorable ditching similar to piston type aircraft, then we must revise our whole attitude toward the problem of personal safety. This is evident in the present day development of the partial pressure suit and K-1 helmet, the constant wear anti-exposure suit, the ventilated vest, better means for flotation, new electronic signaling devices, and the diversity of new materials for survival equipment. Finally, since all survivors are heartened by the thought that they are being sought for it is well to consider the improved techniques, operating know-how and doggedness with which the Air Rescue Service carries out its mercy missions. We are launched into an era of stratospheric flight and by tradition committed to an intensive program of personnel safety.

Survival at Altitude

Mach speed, high altitude aircraft of limited cockpit capacity with ejection escape systems present technical difficulties for the use of conventional type personal and survival equipment. The answer so far lies in compactness and minimum issues of the most essential items necessary to meet safety requirements. These requirements are best met by the back-pack high-speed parachute which allows the use of seat packed rafts and accessory items, yet holds the overall increase of the body silhouette to a minimum.

The problem of jet aircraft escape is two-fold. One is inherent to aircraft design; the other is the changing chemical and physical conditions surrounding the earth. At high operational ceilings, atmospheric temperature and oxygen gradients are low

A life raft gives better protection from the elements, greater stability and companionship.

and a constant reminder that man was primarily intended to live on the bottom of the aerial ocean. In any emergency, low atmospheric pressure and oxygen deficiency are matters of the first consideration and the prelude to survival on land or sea.

Above 10,000 feet, the lack of oxygen, low temperatures and opening shock of the parachute in high speed jumps makes it necessary to free-fall into warmer, denser air. With an emergency oxygen assembly and an automatic ripcord release, aircrews can leave the aircraft when warranted. Without oxygen equipment or automatic ripcord release, AFM 64-4 (Oct. 1954) says you can fall from 30,000 feet and retain consciousness provided you get out of the aircraft with a minimum of effort.

Modern escape methods involve a minimum of effort but include psychological and physical factors which have a bearing on the problem of survival in the air.

First, there is the natural anxiety attending any emergency. Second, there is the shock of windblast at extreme altitude which may preclude the possibility of holding the breath. Only when ejection is necessary without the benefit of oxygen equipment and automatic parachute release are aircrews faced with a decision. A partial insight into this problem may be derived from the following experience: "Some may question my reasons for opening the chute so soon at extreme altitude, as the general policy seemed to be a free-fall to a warmer altitude with sufficient oxygen as soon as possible; doing this by either counting or holding your breath as long as possible. I discussed this policy with the flight surgeon. He felt that on bailout with no oxygen, it would be better to open your chute while still conscious, taking your chances on anoxia (hypoxia) and frostbite rather than chance anoxia during a free-fall which might probably prove fatal in the event that you passed out prior to pulling the ripcord. I agreed. This is why I opened my chute when I did.

Above 45,000 feet, the only adequate defense against low atmospheric air pressure and the perils of abrupt decompression is partial pressurization of the body. As heights approach 65,000 feet or higher, body liquids "boil." For this reason pressure suits or a capsule system of ejection enclosing a shielding envelope of more normal air characteristics are the only safe methods by which humans can descend from great heights in safety.

Duress

One incident worth repeating occurred at Eglin Field in 1945 during routine test of a "man from Mars" pressure suit. The writer was instructed by the test officer, Major Peter F. Scholander (now Professor of Zoophysiology at Oslo University, Norway), to take him to the highest simulated flight pressure possible in a low pressure chamber. At a simulated altitude of about 60,000 feet, the special compressor which maintained a normal air pressure within the suit began to smoke. Pete's discomfort was immediate and apparent. We—being mindful of the blood hazard and fearful that he would lose self-control, worked feverishly to compress air back into the chamber. Fortunately, the descent was in time. The survivor, obviously exhausted, admitted that only with the utmost restraint had he controlled his desire to disconnect the offending hose. This experience illustrates that presence of mind when under duress is essential to success in survival.

The most valuable property a man in the water can possess is buoyancy. This obvious truth is stressed repeatedly in all survival narratives. Yet, as late as 1956, Headquarters USAF made an official note of the fact that some aircrew members have drowned after over-water bailouts without proper survival gear. Proper survival gear includes a life raft which is necessary for an existence of any length because it provides a platform on which to relax, to live and to hoard all personal possessions from loss in the sea. Without the means of flotation, but providing a man can swim, how long can he survive? This depends on various conditions. First, with apologies if the question sounds ridiculous, how strong is his feeling for self-preservation? Second, has he strength and lasting power? Third, what is the water temperature?

This we know—that men with high odds against their chances for rescue and non-swimmers have succeeded in being saved. Literally, they clutched at straws—floating wreckage and jetsam from their aircraft. Some made effective water wings of their trousers or shirts if they did not happen to be

The most valuable property a man in water can possess is buoyancy. Ask the experts.

wearing a one-piece flying suit. Others swam 15 to 20 miles before gaining a beach and often spent as many hours in the water. The longest survival swim without support was made by a naked Dutch submariner who reached the Java shore after 35 hours of continuous swimming. The longest swimming period with a Mae West lasted 73 hours. Of the two airmen who struck out for shore in the latter incident, the larger and physically more fit for the ordeal, tired and gave up in the first 24 hours.

Experience in salt water swimming, the ability to adjust mentally and physically to various seas, and above all the faculty to relax, has saved men's lives even under severe sea conditions. Water temperature, however, is a more disconcerting factor because exhaustion is hastened by cold and rapidly diminishes the survival time. Official sources state that immersion below 31 degrees Fahrenheit is considered fatal within one-half hour. But even long immersions in tropic waters can be chilling while in temperate waters below 68 degrees Fahrenheit. Cumulative cold and fatigue will gradually wear down the staunchest physique.

What is your feeling for self-preservation? Have you the strength and lasting power?

Since we don't have a serviceable all-weatherproof life raft, we can mark the constant wear anti-exposure suit as the principal and most valuable contribution to sea survival. A man on a dry platform, with the ingenuity to forage off the sea, can hold out with greater comfort.

Flotation Gear

The factor contributing most to the success of the previously cited 73-hour survival was a Mae West with a modified headrest which permitted brief periods of sleep without danger of drowning. A serious defect of all pneumatic vests worn under the chute is that the chute must first be removed before inflation.

Most deaths from drowning occur during this phase of the landing when men panic and inflate their vests before getting rid of their chutes. The new water wing flotation gear can now be inflated before the chute is jettisoned. However, the possibilities of unconscious men drowning in the masks of the partial pressure suit is to be considered when the oxygen bottle is strapped to the leg. The issue of individual life rafts is an important concession to safety on the sea, and a necessary accessory for ejection escape systems. Although similar in weight and shape to the C-2 series, the new PK-2 pack seat raft is of better materials, more accessible to the survivor and reasonably foolproof in inflation. The 20-man raft is a happy solution for large crew or passenger lists. Although it crowds more misery into one raft, it also gives better protection from the elements, greater stability, larger supplies of provisions and companionship; for nothing is so desperately monotonous as the sea.

The record for long survival at sea goes to Poon Lim who drifted 133 days on a ship's raft. On a rigid platform, life is relatively comfortable since the unyielding structure acts as a buffer between the man and the constantly oscillating water. Poon Lim did well for himself through foraging and when picked up had lost no apparent weight.

The record for long survival on a flexible life raft was made by Captain Lou Zamperini and a companion in a remarkable 47-day drift of 1200 miles in which the Captain reported a loss of 87 pounds. This loss in weight appears to be more normal for a drift of that length but it is not necessarily related to the ability to forage. Most people appear to regard life on a raft as one of comparative repose. A pneumatic life raft with a three-eighths flexible bottom is like a drum and transmits every bounce of the sea.

Survivors, and more generally lone handers in small rafts, complained of the inability to rest for any but the shortest periods, because of the constant drubbing of waves on their cramped buttocks. Consequently, lack of sleep contributed to their fatigue. This is an unpleasant aspect of pliable rafts but hardly a good reason for black-balling a piece of equipment which can bring you to safety. It is, however, another bit of information picked up through experience. Just ask the experts—Dixon, Pastula, Aldrich, Madden, Zamperini, Rickenbacker, Twining and a host of others who are names on official survival interrogation reports.

A Final Word

Survivor reports show that men who had to rely on printed instructions at sea often fared badly when the emergency occurred at night or under severe weather conditions. It goes almost without saying that aircrews should be familiar with their personal and survival equipment—in detail. If a survivor in a pitching raft at night can lay his hands on the precise item necessary for his use, or replace it with the surety that it will be in place in the morning, then he has learned the first lesson of survival. Test your own proficiency. See if in a given period of time and blindfolded, you can expertly lay out, set up, manipulate, use or replace the various items of the survival accessory kit while sitting in one position. Can you tell the difference by feel between the various first aid items, or unseal a food or signal container?

Crews near the ocean have unexcelled opportunities for testing their raft skills under natural conditions. Those stationed inland should not accept success in a swimming pool as a sign of proficiency; the sea is different. At night, the sea and unfamiliar gear can be both different and strange. ●

WELL DONE

Capt. John D. Heller

41st Air Rescue Sq., Hamilton AFB

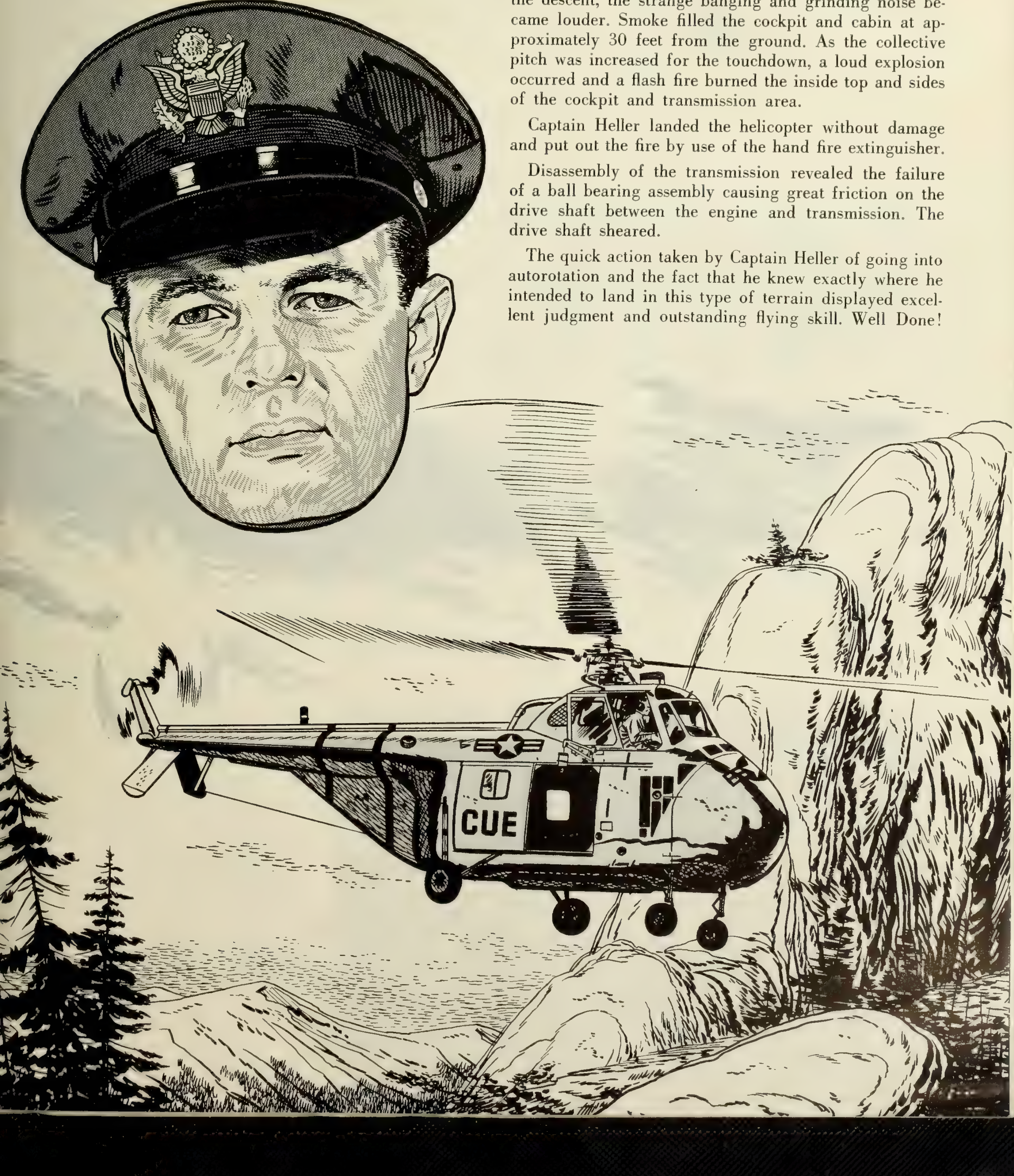
CAPTAIN JOHN D. HELLER was flying an H-19A helicopter on a rescue search mission with two other crewmembers aboard. They had been searching at an altitude of 500 feet along a coastal mountain ridge for a missing jet airplane. The air was turbulent and required constant attention at the controls. Suddenly a strange noise was heard and a power loss was noted.

Captain Heller immediately turned the helicopter toward a nearby valley, lowered the collective pitch and started a descent in autorotation to a small field. During the descent, the strange banging and grinding noise became louder. Smoke filled the cockpit and cabin at approximately 30 feet from the ground. As the collective pitch was increased for the touchdown, a loud explosion occurred and a flash fire burned the inside top and sides of the cockpit and transmission area.

Captain Heller landed the helicopter without damage and put out the fire by use of the hand fire extinguisher.

Disassembly of the transmission revealed the failure of a ball bearing assembly causing great friction on the drive shaft between the engine and transmission. The drive shaft sheared.

The quick action taken by Captain Heller of going into autorotation and the fact that he knew exactly where he intended to land in this type of terrain displayed excellent judgment and outstanding flying skill. Well Done!



the Voice from Below

Sometimes it seems as if all of the breaks are against a man. A pilot may find himself in a jam through no fault of his own. Such was Mickey O'Hara's predicament.

But Mickey was lucky. When all the chips were down, someone heard him call, "This is an emergency."

This article by Maj. Robert E. Fuerst, 1809th AACS Group, is based on an aircraft "SAVE" made by AACS men on Okinawa, on 3 February 1956. In a letter of appreciation to the Naha DF and GCA crews, the T-33 pilot said, "Performance such as this gives a pilot confidence in the men who operate the radio and radar equipment. It certainly reflects credit on your organization and on the U. S. Air Force."

★ ★ ★

IT STARTED OUT in routine fashion; a typical flight, seemingly just like any other. And when he took off, everything appeared in order. There was no hunch about the trip, no feeling of alarm in his chest.

He was in his twenties, this young Air Force Lieutenant Mickey O'Hara. He was flying a T-33 from Itazuke, Japan, to Kadena, Okinawa. And he was enjoying the flight, watching the colors of the sky as the sun sank toward the horizon.

Mickey pulled his eyes off the glorious sky colors and looked over the cockpit. Everything in order. Ample fuel. Glancing at his watch, he figured it would be another 15 minutes. He spoke to the man in the back through the interphone system. "Eighteen-thirty, Tex. Just about another quarter hour."

"Rog, it won't be long now. I wonder if they still have Nick's band and Thelma at the club."

Mickey grinned and punched a button. "Okinawa Control from Chestnut Green. Do you read?"

"Chestnut Green from Okinawa Control. Read you loud and clear. What is your position?"

"Rog, Okie Control. I'm in a T-Bird about a hundred out. What's the latest weather at Kadena?"

"The 1800 Kadena weather is 700 overcast, two miles, rain showers. Wind northwest at 15."

"Roger, Okie Control. Chestnut Green out."

Mickey whistled. Something must have moved in. They were forecasting 2000 broken with unlimited visibility when he took off.

When you flew to Okie, there were

no alternates. Normally, this wasn't much of a problem in conventional aircraft, for even during poor weather there were temporary breaks. But with a jet it was different. A jet couldn't hold for two hours and wait for a break. A jet was supposed to find pretty decent weather on arrival. Oh well, 700 and two wasn't so bad. As long as it didn't get worse.

It was dark by the time he reached Okinawa. There was no indication of land below; clouds extended as far as he could see and scattered buildups towered over the whole area. He began to get a swing on the radio compass and gave GCA a call.

"Kadena GCA from Chestnut Green, over."

"Chestnut Green, Kadena GCA. Go ahead."

"I'm over King Dog homer, GCA. In a T-Bird. What's the latest weather?"

"Stand by one."

Mickey's eye was caught by a flickering on the panel. It was the compass needle jumping about erratically, sweeping the whole 360-degree circle periodically.

"Chestnut Green, Kadena GCA with your weather. Special observation at 1840. Estimated 600 overcast, one mile, heavy rain. Over."

"Roger. How's Naha?"

"Naha is the same. Six hundred overcast, one mile, rain. We have you on radar now—good radar contact."

"Okay, we'll come into Kadena."

Mickey switched to interphone and said, "Hear that, Tex?"

"Yeah. Have fun."

Mickey began the letdown guided by the voice of GCA. With the compass out, he soon lost all notion of where he was in relation to the field and had to rely completely on the unseen director somewhere down below. He eased the T-Bird lower and lower and worked his way methodically around the pattern.

"Okay, Chestnut Green, turn left to a heading of zero-five-zero. This is your final."

"Roger."

"Continue letting down. Your altitude is good."

He was down to 800 feet and then suddenly GCA said, "Pull up, Chestnut Green! Pull up and go around! We lost you in the heavy rain."

Mickey eased back on the stick and made a go-around. He followed directions for a second approach. As he dropped down to about 700 feet the voice of GCA again barked, "Pull up! Pull up, Chestnut Green!" They lost him again.

He couldn't do this forever. Looking at the fuel indicator he frowned thoughtfully. Once again he started the traffic pattern. This had better be it. He was on final now. One thousand, 800, 700, 600 . . . there was GCA again. "Pull up, Chestnut Green! Pull up immediately! The rain is too heavy and weather returns are blocking you out on our precision scope. We've lost you completely."

Mickey groaned and pulled back on the stick. Glancing at the fuel gage, he shook his head. There was less than 15 minutes fuel. And he was completely disoriented now, not having the faintest idea where he was in this murk. It had turned out to be quite a day. And it wasn't over yet.

Well there was no time to lose. "Kadena GCA from Chestnut Green. I'm declaring an emergency. Repeat, I'm declaring an emergency. I'm down to 12 minutes fuel now. Will you be able to bring me in?"

"Negative, Chestnut Green. Switch to guard channel and contact Naha GCA. I say again, switch to guard channel and contact Naha GCA."

"Roger, GCA. Sayonara."

Mickey punched at the new frequency button and said, "Naha GCA from Chestnut Green. This is an emergency. How do you read?"

It seemed like minutes but it was actually seconds, he supposed, before he had an answer. But what an answer! Clear and confident tones and a voice full of optimism. Mickey felt a little of the tenseness slide away as he listened.

"Roger, Chestnut Green, this is Naha DF. GCA has you on radar and will take over in a moment. You are about 20 miles north of Naha. Turn to a heading of one-nine-zero degrees. This will bring you overhead."

"Roger, Naha, will do."

And in a few minutes, "Chestnut Green from Naha GCA, how do you read?"

"Read you loud and clear."

"Roger, Chestnut Green. You're now about five miles west of Naha. Make a left turn to a heading of zero-five-zero and descend to 1500 feet."

"Roger, GCA." Sneaking a look at his fuel, he added, "Make it as quick as possible, GCA."

"Roger. Naha is way below minimums now. We'll give you a surveillance approach to Kadena. Weather at Kadena is 400 overcast, one-half mile, heavy rain."

"Roger." Mickey wiped his brow with his sleeve and crossed his fingers. The weather was number ten. And he was about out of fuel. If ever a man needed a good break, this was the time!

Mickey watched the altimeter needle as it steadily turned. He was at 700 now. Ought to break out pretty soon. Six hundred. Five hundred. And still as thick as ever. Dark. With heavy rain pounding at him. Now four hundred. Still no ground in sight. What's wrong? It wasn't too late to pull back and zoom up enough for both of them to get out of this rat trap. There should be enough time for that.

Mickey ran his tongue over his lips as GCA said, "You're right on the centerline."

He hesitated and then eased the stick forward. You've got to trust those men down there. Almost at once he was below the clouds, breaking out at about 300 feet. It was raining so hard that he could scarcely see.

Lower, lower, lower.

"You're over the end of the runway now."

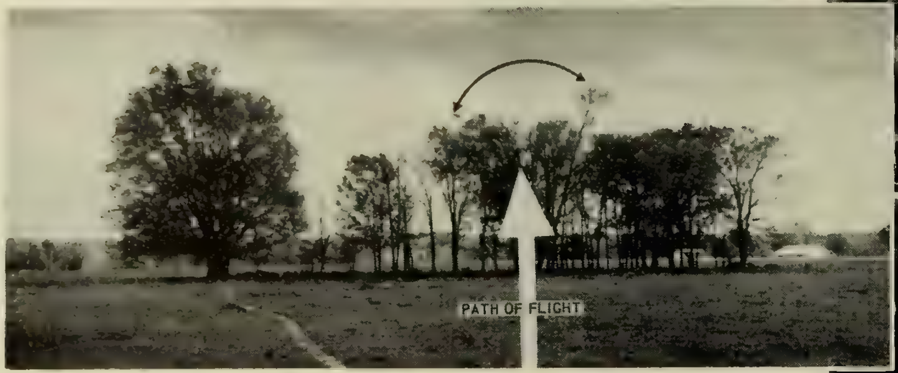
There it was! He shoved hard on the right rudder and scooted over slightly, then he set the bird down.

Mickey got the T-Bird under control and turned off the runway. "Thanks, GCA," he said. "Mighty nice work."

He flicked to interphone. "Well, we made it, Tex boy.

"Barely. I'll have to buy you a steak for that one though. You know, something's just occurred to me. Kadena must be equipped with the older MPN-1, GCA equipment. That's why the rain cluttered up the scope. With the CPN-4 at Naha, the circular polarization feature eliminates the rain clutter. We'll have to remember that the next time we come here."

Mickey smiled and the smile lingered for some time. The day had started in routine fashion but it sure was ending on a melodramatic note. And the ending was happy, thank goodness. He'd better look up those GCA people and give them a pat on the back. They had done their good deed this night. ●



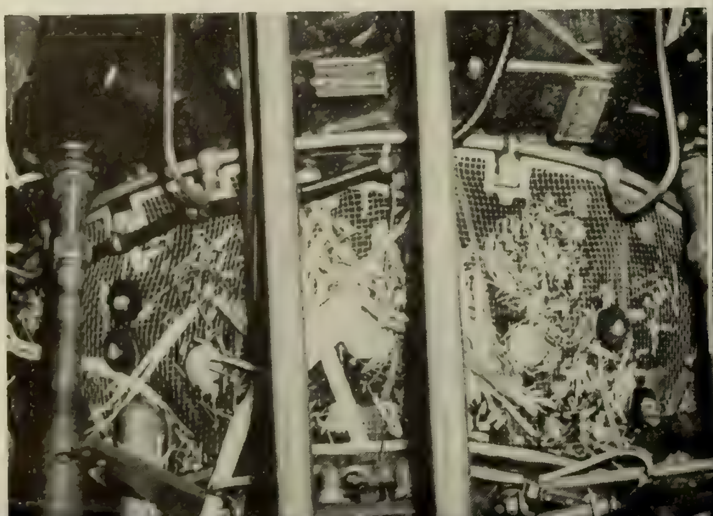
Above, the T-33 flew through the tops of a group of trees, cutting a clean swath. Right, notice the size of some of the limbs. Still the aircraft flew back home. Below, this is the pile of wood that entered plenum chamber through the intakes.

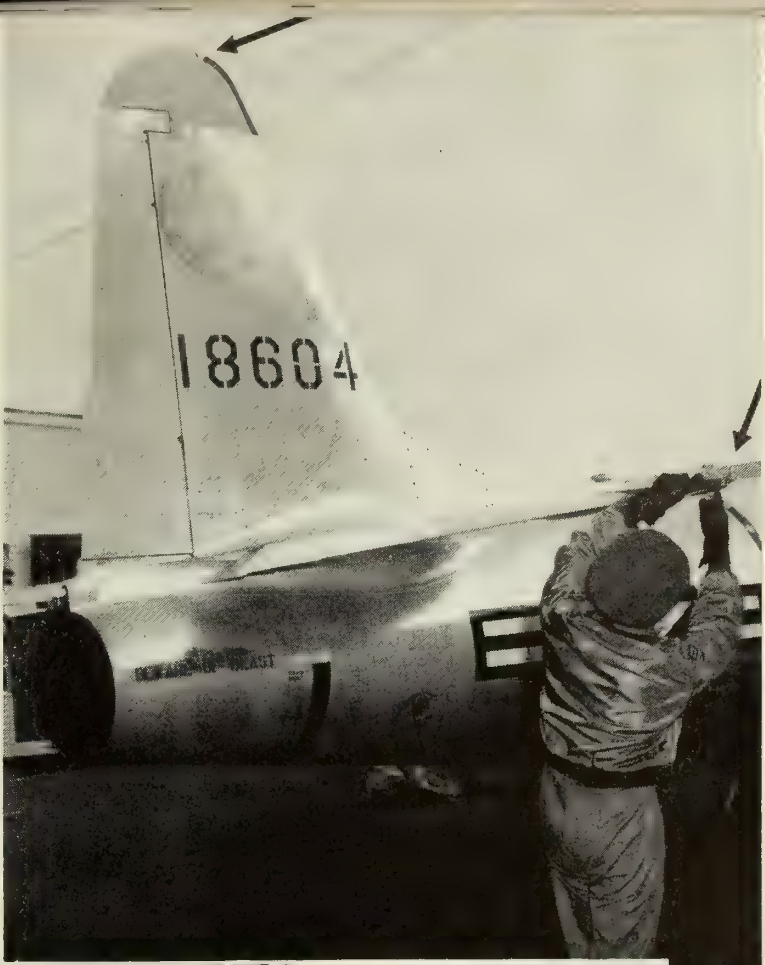
Not Recommended!

FLYING SAFETY doesn't recommend flying through trees with the Tango Three Three; however, for those who love to say "They don't build 'em like they used to," here are some examples of the ruggedness of today's aircraft. The pilot of this bird was simulating a forced landing pattern, using a clump of trees as a runway reference. Pictures speak louder than words so it would be somewhat naive just to say, "He goofed."

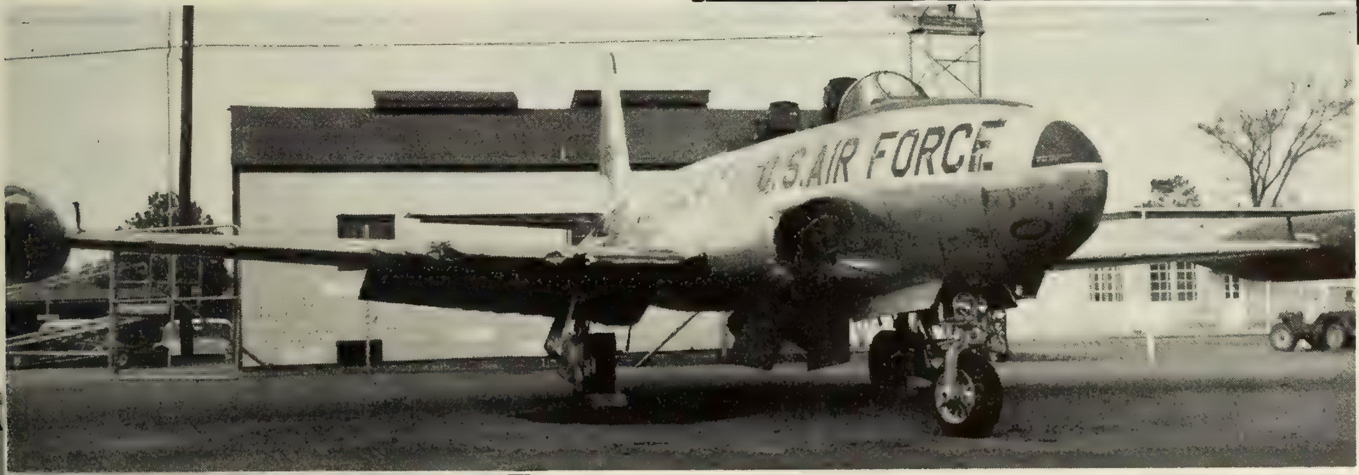
The point is that he flew the T-33 back home, carrying no small amount of timber with it. ●

With the plenum chamber access door removed, twigs varying in size and chips of wood can be seen. Right, tree branches did much damage to left intake duct and wing.

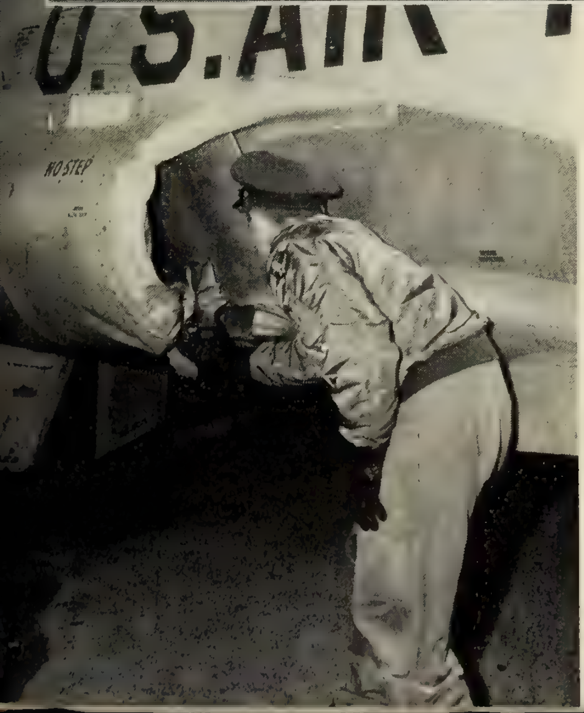


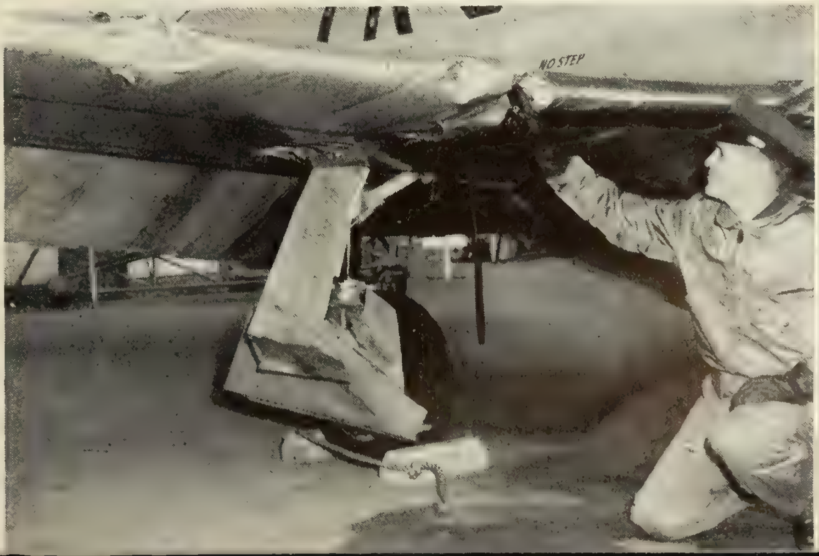


Pictured here are the large trees that sustained most of the impact. Right, damage to vertical and horizontal stabilizers clearly show that the aircraft flew below the trees tops. Note overall shot below.



Left, shows damage to the right intake. Right, indicates the force of the impact. The leading edge, underside and root of the wing were hit hard.





Eight RFC charts covered the U. S. in 1937.

Have you used the Special Edition of the Radio Facility Charts? Did you know you now have a choice of RFCs? Here's the complete story.

SAME BOOK ...NEW LOOK

Albert P. Litwa
ACIC, USAF

HAVE YOU EVER stopped to think what the Radio Facility Chart (RFC) means to you? It's like an insurance policy that pays dividends when the chips are down. It is always there when you need it.

Many conveniences make our daily lives safer for our families in the home. These things are routine because they are so familiar to us. We take them for granted. However, their importance is realized when the convenience of one of these safety measures is lost to us. Likewise, take away your RFC and you will realize its vital importance to aviation.

Air traffic has increased tremendously since the '30s. More highways in the sky were necessary to handle this increase. Consequently, more traffic aids were needed. In 1937, a Radio Facility Chart was produced by the U. S. military—eight handy charts which covered the United States. With each passing year, aerodromes were constructed and more navigational aids were installed; therefore more flight destinations were available. The continued increase in radio aids and the commissioning of new airways resulted in congested charts that fathered the requirement for some other means of presentation. A considerable number of charts were required to adequately portray the expanded airways system. Therefore, the decision was made that a Radio Facility Chart in a bound form would best satisfy the operational needs of the time.

Sometime later, a new airways system (VHF Omni Directional Range —VOR) came into being. Initially, graphic portrayal of the VOR system was combined in the Low Frequency RFC, but as additional airways were established, the charts became hopelessly congested. To overcome this, a separate VOR edition was produced.

The problems involved in the development and production of these charts are many and varied. The matter of deciding what will be included and how it will be presented is a complicated process. Not all information published is required by everyone for everyday use but it is needed by most pilots at one time or another. Portrayal and format are based on operational use. Data contained in the RFC is for both in-flight and preflight planning information. Flight planning information and in-flight data of a more stable nature are included in the Supplementary Flight Information Document (SFID).

The United States Radio Facility Chart is produced every two weeks because of the frequency of changes required. There are changes on approximately 75 per cent of the pages every two weeks. The average is about six changes per page. Airways are constantly changing as are radio frequencies and reporting points. The "corrected to" date on the front cover means that data is current as of that date. Therefore, all NOTAMS subsequent to that date should be checked. It takes time to print and distribute the RFCs so an approximate distribution date also is shown. If you are not sure whether you have the latest chart, check the distribution date and add two weeks to it. If it's past that date, check with the base operations officer for the latest copy; the one you have is obsolete.

When there are important changes in the RFCs, they are brought to your attention by a Special Notice on the front cover. If you aren't flying a route regularly, it's a mighty good idea to check the Special Notices before you plan your flight. Those just recently added will be boxed, indicating the effective date. Special Notices also are boxed when there are changes to the existing notices.

There are many changes in Prohibited, Restricted and Warning areas. To avoid a violation, you should check the tabulation pages to see if any changes have occurred or if new areas have been added. You may be using a World Aeronautical Chart that hasn't been brought up to date. If it's an addition or a change, you will see a heavy black box around the area number. This box is shown for two issues, then dropped.

You can see by all this that the RFC was designed for you and is being continually modified to meet your needs. However, needs of different units vary. Major Air Commands each have a specific mission to accomplish. Even though navigation in all types of aircraft is essentially the same, different techniques are used. Cockpit configuration is a major consideration in determining the most suitable style to be used.

Sheet Type RFC

Early in 1953, the Air Defense Command indicated specific requirements for a sheet type RFC which would be particularly suitable for jet aircraft operation.

Development of the Experimental Radio Facility Chart (XRFC) got under way. It was determined that 13 charts were required for United States coverage. One side contained low frequency radio information and the other VOR. The charts were folded to allow each fold to be turned like the pages of a book to permit easier use in the small cockpit of the single place jet.

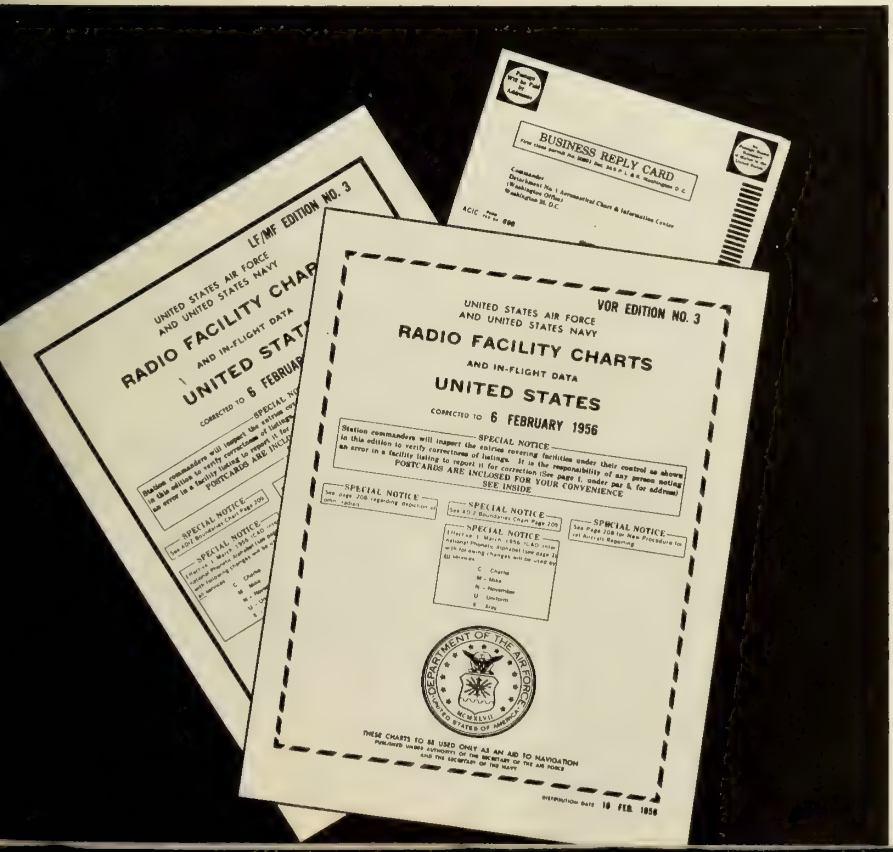
Each fold was indexed to indicate the most prominent and/or major facilities they contained. The charts were designed so that they would fit in individual envelopes which were divided into two sets and would easily fit in the leg pocket of the flying suit. Test and evaluation of these charts proved that they had certain advantages over the book type RFC. Results indicated, however, the requirement for additional detailed data. Therefore, ACIC issued an experimental In-Flight Data Booklet which contained GCA, ILS and other data as required for in-flight use. Even though the XRFC was a definite improvement over the book type RFC, it still was not completely adequate for operational use by all commands. A second test was conducted and many modifications to the existing charts were made then.

To avoid issuing dual editions of the Radio Facility Chart, Headquarters USAF policy states that if the XRFC (renamed Special Edition) is required by units, the standard book type quantities must be reduced proportionately. Where conversion has taken place, limited quantities of the book type are still available in base operations offices for reference.

In February, 1956, the Special Edition came out with a new look and a new color—red. A new area of coverage is reflected allowing more overlap and consisting of only 11 basic charts, with two blow-up charts referred to as Supplemental Area Charts. The scale of the basic charts is still 1:2,000,000, but now we use the same projection as the JN charts. The Supplemental Charts are at a scale of 1:1,000,000.

The abundance of navigational aids concentrated on individual aerodromes together with the increase in designated airways to provide for increased traffic are the principal reasons for having these blow-up charts. Blow-up charts of congested areas are shown as inserts on individual chart sheets. The areas considered highly

Every two weeks there are changes on approximately 75% of pages of Radio Facility Charts.



BUSINESS REPLY CARD

Commander
Detachment No. 1 Aeronautical Chart & Information Center
(Washington Office)
Washington 25, D.C.

VOR EDITION NO. 3

UNITED STATES AIR FORCE
AND UNITED STATES NAVY

RADIO FACILITY CHARTS

AND IN-FLIGHT DATA

UNITED STATES

CORRECTED TO 6 FEBRUARY 1956

SPECIAL NOTICE
Station commanders will inspect the entries covering facilities under their control as shown in this edition to verify correctness of listings. It is the responsibility of any person noting an error in a facility listing to report it for correction (See page 1, under par 5 for address)
POSTCARDS ARE INCLOSED FOR YOUR CONVENIENCE
SEE INSIDE

SPECIAL NOTICE
See page 208 regarding depiction of omni radials

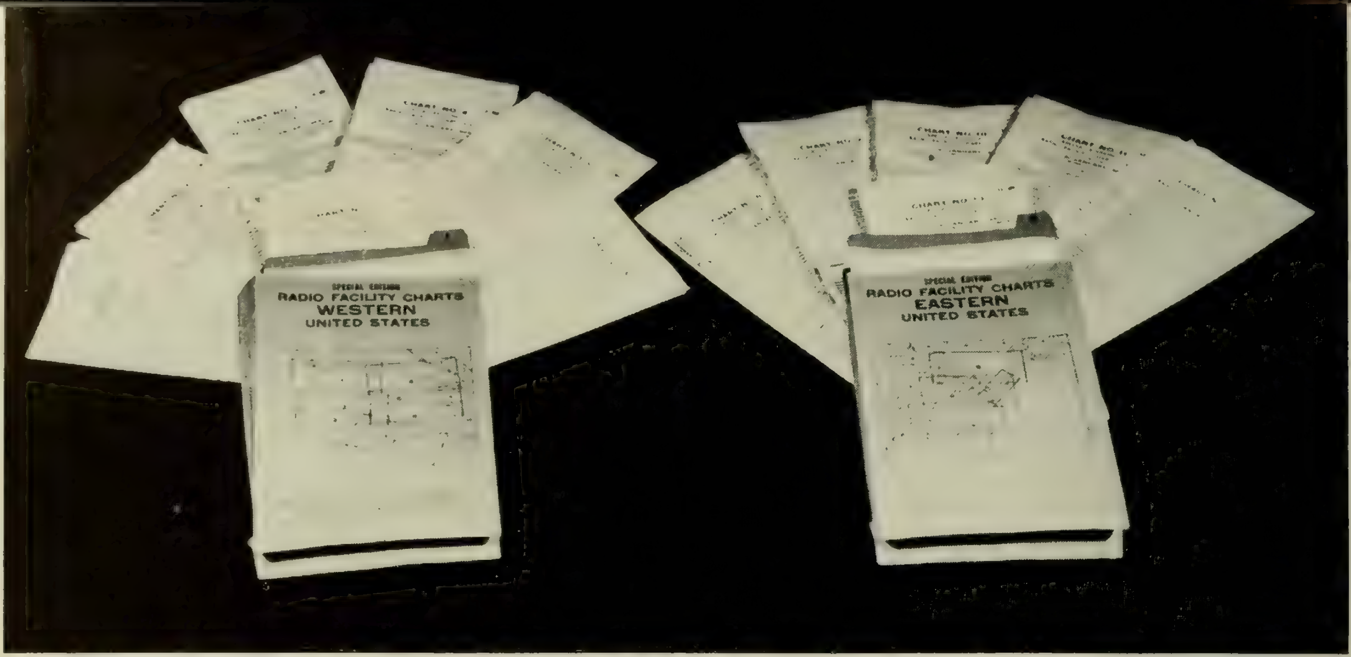
SPECIAL NOTICE
See AD 2 Boundaries Chart Page 209

SPECIAL NOTICE
Effective 1 March 1956 ICAO International Phonetic Alphabet (see page 3) with following changes will be used by all services
C Charlie
M - Mike
N - November
U Uniform
X Xray

SPECIAL NOTICE
See Page 208 for New Procedure for 1st Aircraft Reporting

THESE CHARTS TO BE USED ONLY AS AN AID TO NAVIGATION
PUBLISHED UNDER AUTHORITY OF THE SECRETARY OF THE AIR FORCE
AND THE SECRETARY OF THE NAVY

DISTRIBUTION DATE 10 FEB. 1956



The new sheet type RFC is particularly suitable for jet pilots. U. S. is covered by 13 charts.

congested at this time are Norfolk to Boston, and Pittsburgh to Chicago. To include as much area as possible within the sheet limits, some charts are oriented other than North-South, East-West. The textual data are positioned relative to true north so that you are continuously oriented.

Deviations

The charts (with the exception of the data panel) contain essentially the same information as the book charts. Omitted are the time zones, minimum crossing altitudes, minimum reception altitudes, aerodromes of less than 5000 feet, talk-to-met stations, all nonstandard holding patterns, marine beacons, and there are some other minor deviations.

All aeronautical data are plotted in its true geographical locations, whenever possible. Should it be necessary to displace symbols from true geographical positions to improve readability, preference is given to the accurate plotting of radio facilities. Because of the size of symbols used, when a radio beacon and an aerodrome are located within two nautical miles of each other, then they are superimposed.

Since these Radio Facility Charts are primarily used under instrument conditions, certain facilities are portrayed more prominently than others. Radio Facilities which are part of an airway are given first priority portrayal, along with all Air Force bases and terminal areas. To get the proper effect, data boxes are accentuated by shading two sides.

Aerodromes portrayed on the charts are those active fields at which military landing rights are in effect with a minimum of 5000 feet of hard surfaced runway with either a combination of Jet Fuel, JASU, a published JAL chart, or minimum lighting facilities. All other aerodromes not within this criteria, but with 5000 feet or more of hard surfaced runway, are shown as emergency fields.

Radials always have been shown outbound from VOR stations on airways even though LF radio range courses are shown with inbound headings. But bearings from VOR stations (added to form intersections

Choose the publication that meets your needs. Operational use determines that type for you.

with other facilities) have until recently been shown inbound. It was found that confusion resulted from this depiction since these bearings were in effect radials, too. Pilots called ARTC, stating they were on a 320-degree radial. ARTC would place the aircraft in the northwest quadrant when actually the pilot was in the southeast quadrant on an inbound bearing of 320 degrees. Now all radials are shown outbound. So when you report that you are on a radial, you will be reporting accurately an outbound bearing.

To ease flying in congested areas, blow-up charts have been provided. For those flying through such an area, essential en route information is shown on the primary chart. Only those radio facilities used to establish the airway are portrayed and identified in full. Detailed information, including holding patterns, is displayed on the blow-up box. When the bearing of the holding pattern is not obvious, it is shown.

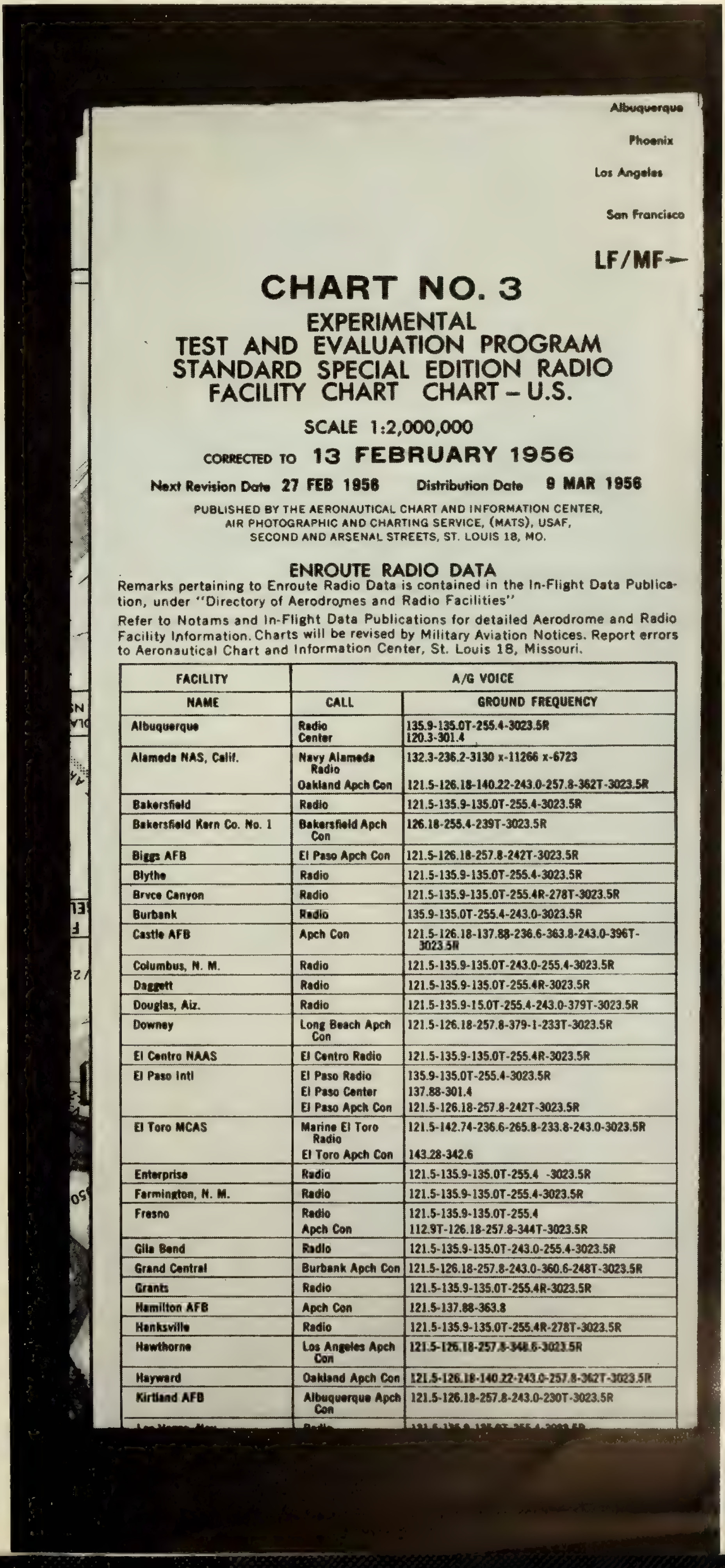
Selected aerodrome data are included on the outside fold of the chart. Only primary tower frequencies for each aerodrome are given.

Each chart is numbered with the date of currency in bold print. In order that you may know if you have the latest chart available, the next scheduled revision date is given along with the distribution date. How soon you will receive your new charts will depend upon distribution channels.

Bulletins

Bulletins, called Military Aviation Notices (MAN), are furnished so that you will have the most current information available. Changes that occur while the charts are being printed are included in these notices. When you get a new MAN, throw the old one away because the new one also includes all of the old changes. So what do you do with them now? Well, if you're not going anywhere, just put them in the appropriate holder (East or West) in the first fold, for use when you make your next flight.

When you plan a flight, first determine the charts you will use, then the approximate route you intend to fly. Refer to your MAN and see if there are any changes along the planned route. If there are, you make a mental note or simply make the necessary change, and put the MAN back in the folder for the next pilot. If you are



Albuquerque

Phoenix

Los Angeles

San Francisco

LF/MF→

CHART NO. 3
EXPERIMENTAL
TEST AND EVALUATION PROGRAM
STANDARD SPECIAL EDITION RADIO
FACILITY CHART CHART – U.S.

SCALE 1:2,000,000

CORRECTED TO 13 FEBRUARY 1956

Next Revision Date 27 FEB 1956 Distribution Date 9 MAR 1956

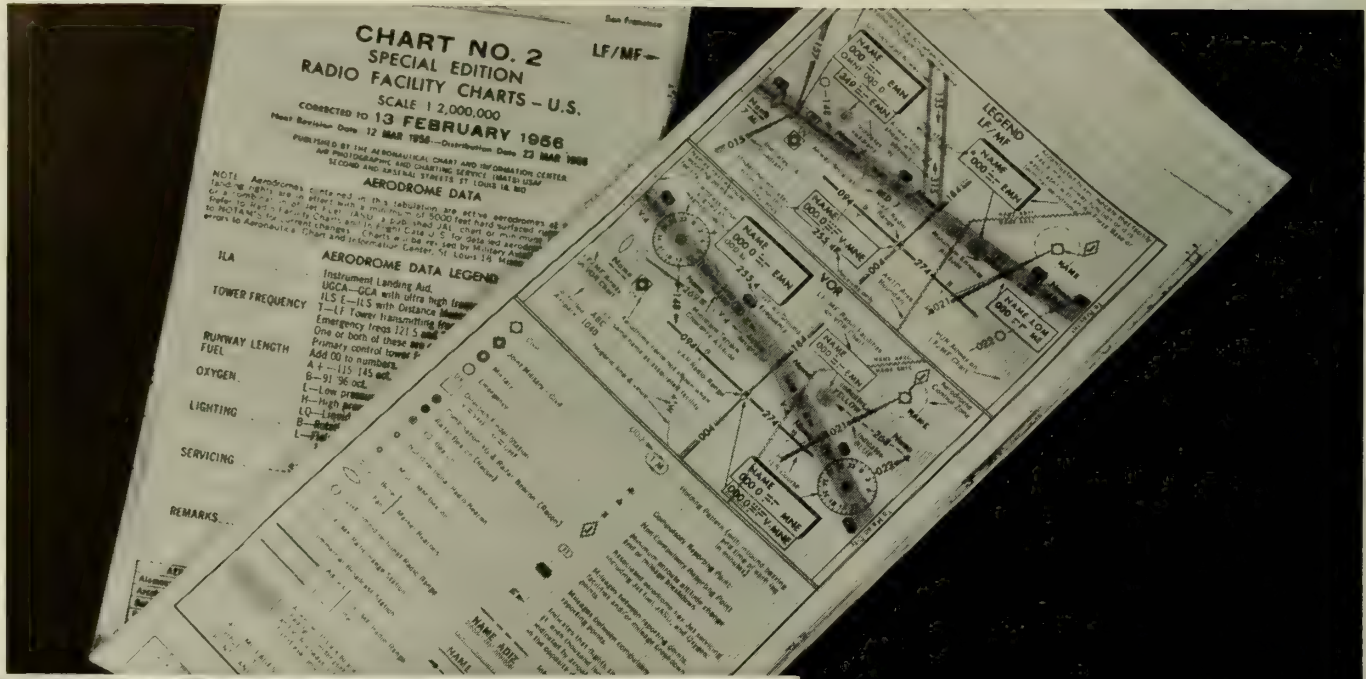
PUBLISHED BY THE AERONAUTICAL CHART AND INFORMATION CENTER,
AIR PHOTOGRAPHIC AND CHARTING SERVICE, (MATS), USAF,
SECOND AND ARSENAL STREETS, ST. LOUIS 18, MO.

ENROUTE RADIO DATA

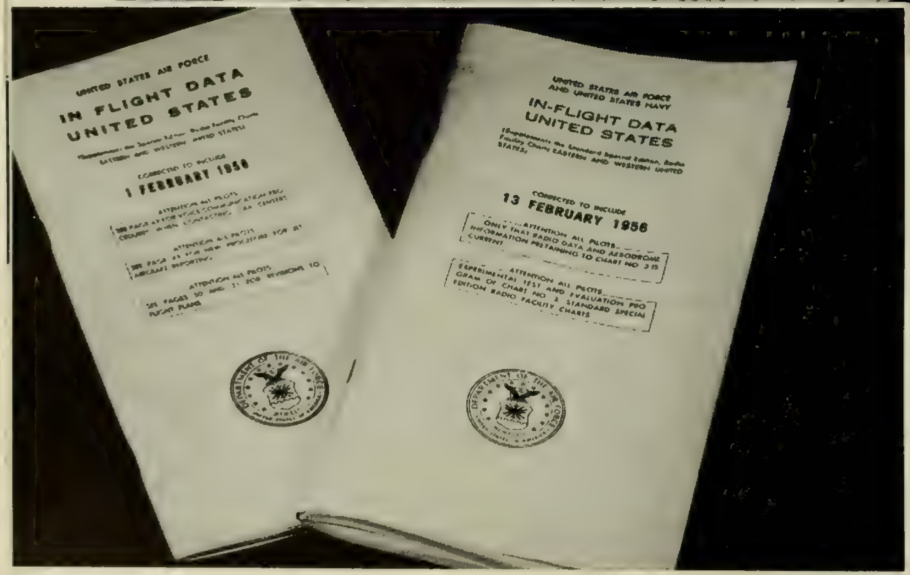
Remarks pertaining to Enroute Radio Data is contained in the In-Flight Data Publication, under "Directory of Aerodromes and Radio Facilities"

Refer to Notams and In-Flight Data Publications for detailed Aerodrome and Radio Facility Information. Charts will be revised by Military Aviation Notices. Report errors to Aeronautical Chart and Information Center, St. Louis 18, Missouri.

FACILITY	A/G VOICE	
NAME	CALL	GROUND FREQUENCY
Albuquerque	Radio Center	135.9-135.0T-255.4-3023.5R 120.3-301.4
Alameda NAS, Calif.	Navy Alameda Radio Oakland Apch Con	132.3-236.2-3130 x-11266 x-6723 121.5-126.18-140.22-243.0-257.8-362T-3023.5R
Bakersfield	Radio	121.5-135.9-135.0T-255.4-3023.5R
Bakersfield Kern Co. No. 1	Bakersfield Apch Con	126.18-255.4-239T-3023.5R
Biggs AFB	El Paso Apch Con	121.5-126.18-257.8-242T-3023.5R
Blythe	Radio	121.5-135.9-135.0T-255.4-3023.5R
Bryce Canyon	Radio	121.5-135.9-135.0T-255.4R-278T-3023.5R
Burbank	Radio	135.9-135.0T-255.4-243.0-3023.5R
Castle AFB	Apch Con	121.5-126.18-137.88-236.6-363.8-243.0-396T-3023.5R
Columbus, N. M.	Radio	121.5-135.9-135.0T-243.0-255.4-3023.5R
Daggett	Radio	121.5-135.9-135.0T-255.4R-3023.5R
Douglas, Aiz.	Radio	121.5-135.9-15.0T-255.4-243.0-379T-3023.5R
Downey	Long Beach Apch Con	121.5-126.18-257.8-379-1-233T-3023.5R
El Centro NAAS	El Centro Radio	121.5-135.9-135.0T-255.4R-3023.5R
El Paso Intl	El Paso Radio El Paso Center El Paso Apch Con	135.9-135.0T-255.4-3023.5R 137.88-301.4 121.5-126.18-257.8-242T-3023.5R
El Toro MCAS	Marine El Toro Radio El Toro Apch Con	121.5-142.74-236.6-265.8-233.8-243.0-3023.5R 143.28-342.6
Enterprise	Radio	121.5-135.9-135.0T-255.4 -3023.5R
Farmington, N. M.	Radio	121.5-135.9-135.0T-255.4-3023.5R
Fresno	Radio Apch Con	121.5-135.9-135.0T-255.4 112.9T-126.18-257.8-344T-3023.5R
Gila Bend	Radio	121.5-135.9-135.0T-243.0-255.4-3023.5R
Grand Central	Burbank Apch Con	121.5-126.18-257.8-243.0-360.6-248T-3023.5R
Grants	Radio	121.5-135.9-135.0T-255.4R-3023.5R
Hamilton AFB	Apch Con	121.5-137.88-363.8
Hanksville	Radio	121.5-135.9-135.0T-255.4R-278T-3023.5R
Hawthorne	Los Angeles Apch Con	121.5-126.18-257.8-348.6-3023.5R
Hayward	Oakland Apch Con	121.5-126.18-140.22-243.0-257.8-362T-3023.5R
Kirtland AFB	Albuquerque Apch Con	121.5-126.18-257.8-243.0-230T-3023.5R



Designed to fit into the leg pocket of the flying suit, each chart page is indexed to show major facilities.



New one in the making. It is a combination of the book and sheet type Radio Facility Charts. It is called In-Flight Data Booklet. Certain units are testing them now.

going to be strictly on instruments and will require a letdown at destination, check to see if there are any changes at your destination and alternate. If changes are necessary, pencil them in; then forget about the changes until you're ready to use them again.

New Chart Coming

So far, two types of Radio Facility Charts have been discussed; however, still a new one is in the making. It is a combination of the book and the sheet type Radio Facility Charts. All the information that is now contained in the book type RFC will be included on either the charts or in an In-Flight Data booklet. The charts will contain all of the aerodromes now contained in the book type with en route radio information on the outside fold. The In-Flight Data booklet will be "beefed" up to include the remaining data. Certain units selected by each ZI Major Air Command are participating in a test program to determine the operational suitability of this new product as a replacement for both the book and Special Edition RFC. Units selected are representative of each command's mission. You should know the outcome of the test by this fall.

Some might ask, "Why not improve the book type Radio Facility Chart?" Well, indications are that a sheet type is preferable. The test should determine which type publication is more suitable.

Radio Facility Charts are published primarily to give air crewmembers information that is essential to their mission. Some of you do write to us stating your needs, but probably many of you do not. Post cards are included in the bound RFC for your comments. Every post card or letter received is carefully screened to determine its applicability to the RFC. The more requests received indicating similar changes, the sooner action is taken. Sometimes action is taken to make a change or addition based on comments contained on only one post card. But there again, if you don't ask, it is assumed that what is published is satisfactory.

Remember, it's our purpose to provide you with a publication which meets your needs. However, its effectiveness depends on its use by you . . . so choose and use your Radio Facility Chart. ●

Self Service Wx

Step right up and help yourself to the latest WX. And down Texas way this is how they do it.

EVERY PILOT his own forecaster, well not actually . . . but almost anyway. A step in this direction has been taken by Major Thomas J. Williams, Base Operations Officer, Randolph Air Force Base.

Realizing that pilots are vitally interested in weather developments, but are only exposed to them during visits with the station weather forecaster, he decided to lend a helping hand, and incidentally lift some of the workload off the forecaster.

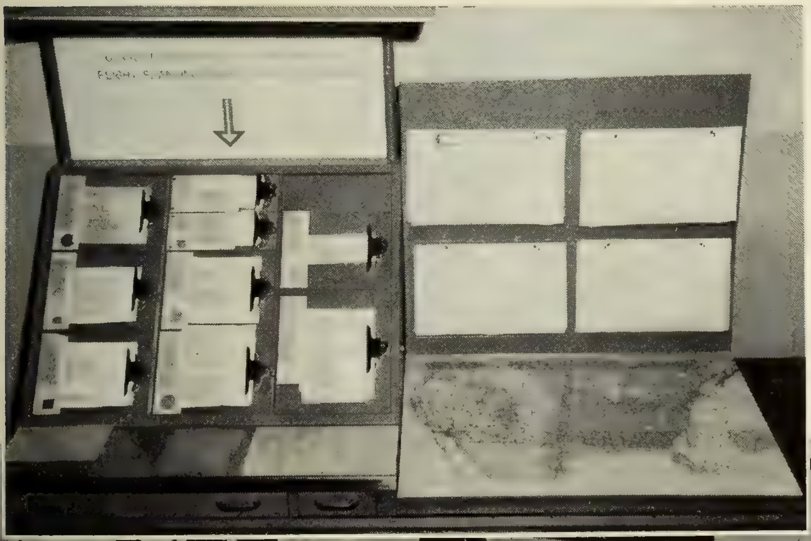
He established a current weather display case in a corner of the flight planning room of base operations. Items that a pilot has for his use include hourly weather sequence clipboards with appropriately colored station identifiers; an up-to-date surface chart; winds aloft charts for all operating altitudes and an airways-weather map of the United States with colored tabs which correspond to the sequence clipboards. An eye-catching sign marked "Pilots" calls attention to this current weather data.

Does it work? In Major Williams' words, "It has worked out very well. It gives the pilot something to stare at. Seriously, though, it relieves the forecaster of continuous elaborate briefings on weather changes and allows him to concentrate on clearances.

"Pilots using the available data feel that the idea pays off. By noting the general weather picture I can often plan my route without ever having to see the forecaster. I can tell if I should file IFR or VFR and can select a suitable alternate. It saves a lot of time, for now I don't have to go to the forecaster before planning my flight. However, I do see him for my actual pre-takeoff weather briefing and clearance.

"Also, by having seen the general weather situation before hand, I feel that I get the maximum benefit from his weather pitch."

Seems like a big step in the right direction. ●



Left, is bargain corner. Display case contains current weather data. Below, pilots use it daily.

SHAKE RATTLE and ROLL

As the title states, this is what you can expect if you fly into the turbulent area behind an aircraft.

CRUISING AT 31,000 feet, the pilot racked his '86 over on its left wing and looked down. Below him, a flight of two other F-86s streaked eastward. He peeled off for a high speed pass. Whizzing underneath them, he zoomed up several hundred feet in front of the unsuspecting jets and slow rolled. He pulled a 4G turn and looked down again. His smile turned to a frozen grimace.

The two F-86s had collided. Why?

★

Four F-84Gs were making a fly-by. They were in echelon to the right. At 250 feet, the lead aircraft, indicating 450-500 knots, pulled up slowly as he passed the reviewing stand. The No. 2 man started his pull-up. His aircraft snap-rolled to the left. Then again. The pilot blacked out temporarily. The G meter read positive 10 and negative 3. The pilot recovered and landed. What happened?

★

The third B-47 of a flight of four lifted off the runway. The tower operator cleared No. 4 for immediate takeoff. The pilot released the brakes and started his roll. He pulled the heavily loaded bomber smoothly off the runway. Then, as if a giant hand was shoving steadily on it, the left wing started to drop. The pilot tried desperately to lift it up. The B-47 mushed back onto the runway. Why?

★

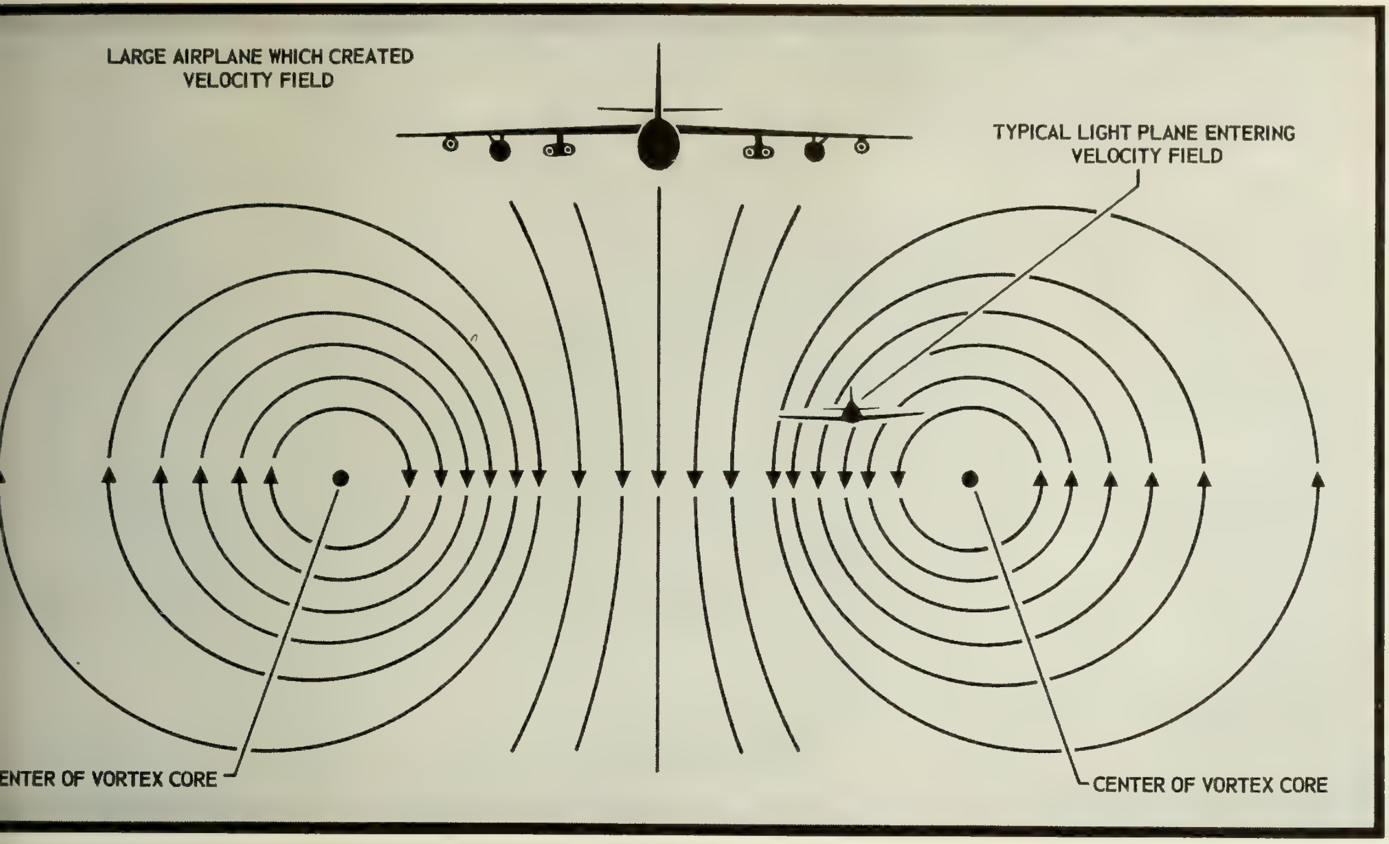
These are just a few of the many stories that can be told about wing trailing vortices. To understand the "why," take a look at Figure 1. It shows the circulation pattern of air currents developed by a six-engined bomber. Notice also the smaller aircraft about to enter this flow pattern.

Statements of pilots who have flown into this wake emphasize in no uncertain terms the severe rolling motion encountered. Jet aircraft, both fighter and bomber types, generate the same pattern of vortices.

Just for the record, here are the definitions most commonly used to describe aircraft turbulence.

- *Wake*—A track or turbulent portion left immediately after the passage of an object through the air. It is produced by the passage of an airfoil or any other solid body through the air.
- *Wing trailing vortices*—A pattern of air which flows or circulates in clockwise and counter-clockwise directions just behind the trailing edge of the wing section during flight. Flow is inward and in opposite directions around each wingtip.
- *Slipstream*—(Often called prop wash) The stream of air driven astern by the propeller.
- *Prop blast*—Same as slipstream except that inference is generally that the airplane is on the ground.

Reflect back to your primary flying school lessons. Remember when you congratulated yourself on a perfect 360-degree turn and flew into your own "prop wash?" Information now available indicates it was more correctly the lingering wing trailing vortices. Some interesting facts have been uncovered about this phenomena. Paradoxically, aerodynamicists and aviation theorists have yakked about vortices for many years with regard to its effects on aircraft performance, but it has taken a rash of unexplained accidents to bring it into focus.


LARGE AIRPLANE WHICH CREATED VELOCITY FIELD
TYPICAL LIGHT PLANE ENTERING VELOCITY FIELD
ENTER OF VORTEX CORE
CENTER OF VORTEX CORE

Wing trailing vortices—sometimes called wake, jet wash, prop wash or slipstream. Avoid it.

Tests performed by the Royal Aircraft Establishment (RAE), Farnborough, England, indicated that the disturbance created by wing trailing vortices will decrease to only half its original force at distances as great as 8000 feet behind the wake generating airplane.

Using a Meteor jet as the vortex generating aircraft and a Vampire jet as the trailing aircraft, the RAE found that a rolling motion was the most severe action encountered. When the Vampire was slipped laterally through the wake, aileron movement required to neutralize the roll was from a maximum of eight degrees in one direction (which is approximately 80 per cent of the aileron travel for this particular airplane) to a maximum deflection of eight degrees in the opposite direction. Time span for the total deflection was four seconds.

An interesting result of the tests was that jet engine nozzle exhaust is not the cause of vortices. During flight, jet engine nozzle exhaust velocity drops to a negligible value 200-300 feet behind the aircraft. This turbulence will be most noticeable during periods of ground runup or initial takeoff roll.

Similar tests by the National Advisory Committee for Aeronautics (NACA) indicate that vortices can persist for periods greater than 60 seconds. No appreciable reduction in vortex strength was noticed for at least 30 seconds. It is significant that an aircraft flying at 10,000 feet at Mach 0.8 will travel five miles in 30 seconds. Atmospheric conditions will tend to influence the dissipation of these vortices.

Other data and theory from the RAE and NACA indicate that control responses of a trailing aircraft will be affected by:

- The wing span and speed of the vortex generating airplane.
- The wing loading of the vortex generating airplane.
- The speed of the trailing airplane.
- Aileron effectiveness.

Wright Air Development Center is currently sponsoring an intensive research project into this phenomena. As specific recommendations are forthcoming they will be brought to your attention.

Knowing the treachery of a wake, what can a pilot do about flying through it? If you are flying a circular gunnery pattern, avoid the wake of the preceding aircraft if possible. The NACA report stated that turbulence created by wing trailing vortices may be a factor in horizontal tail failures of some high speed fighter aircraft.

Don't zoom up in front of a light plane or transport or flight of jet fighters. Why? You're sticking their necks out.

On takeoff, the danger zone of trailing vortices starts at approximately 40 feet above the runway with no crosswind. Below that altitude, ground effect tends to break up the vortex pattern.

Coming in on the final approach, anticipate where you might encounter wake and plan your landing accordingly. Consider the effects of crosswind displacement of the vortex and don't land directly behind a preceding aircraft. Regardless of the type of aircraft you fly—until more information is available, be aware of the hazards of wake. ●

Need some assistance? At your fingertips and only seconds away are many facilities awaiting your request. Time is important. Call for . . .

HELP!

Robert H. Shaw, Research and Analysis Div., D/FSR.

CAST ASIDE your Yankee independence and declare that emergency NOW! The "I can make it" and "wing and a prayer" thinking belongs to the deep, dark past. No pilot ever reaches the point where he doesn't need help. More of our national flying heroes might be alive today had they recognized and admitted this simple truth.

More aircraft accidents than we care to admit originated with an undeclared emergency. Why wasn't it declared? Because the pilot did not recognize or admit that he needed help. Some try to exhaust all other resources first. The trouble is that after all resources are exhausted, it may be too late for anyone to help.

No Valid Reasons

There are probably deep-seated reasons why pilots are reluctant to declare an emergency. Pride, saving face, admitting a mistake and just plain stubbornness are likely ones. No matter what the reason, in the face of an aircraft accident, none of these are valid.

What is an emergency? Sounds silly—an emergency just happens. It can be defined as a condition calling for immediate action. The action called for depends on the condition, but recognition of the condition is the sole responsibility of the pilot. Simplified, it's the first sign of trouble; if it has a dangerous element, it's an emergency.

Recognition of an emergency is most important, but this is only the beginning. What to do when it happens? Declare it! *How?* By contacting the nearest facility or agency, informing them that an emergency exists and requesting immediate assistance. Use the term "*I declare an emergency.*" When? At once—don't wait. Time is important. Why? The answer seems obvious, but let's look.

Pilot Needs Help

First, the pilot needs help. He can't get it unless someone knows about the emergency.

Second, the right people must be alerted to assist him. The declaration will alert other facilities so that lines of communication can be cleared and relay assistance will be possible. Airspace will be physically cleared and made available to the pilot.

Most pilots know there is a wealth of facilities available to aircraft in flight, whether under ordinary or emergency conditions. At the pilot's fingertip and seconds away (with a complete G file and sound radio equipment) are approach and departure facilities such as Air Surveillance Radar, Emergency Radar Interceptor Procedures, ARTC Lost-Aircraft Emergency Procedures, UHF and VHF Direction-Finder Stations, Radar Advisory Service On Storm Areas and Pilot-to-Forecaster Service, just to mention a few. Some pilots do not realize, however, that although some of the services are available round-the-clock, they must be alerted and *upon request from the pilot.*

This is a fact that cannot be overemphasized. Pilots in contact with a radio range station, encountering trouble in the air, sometimes assume that the radio range station will automatically alert other facilities for him. This is not necessarily the case. The

An emergency must be declared to insure immediate, positive and individual assistance.

pilot must realize that he himself must act as the guiding hand. Any assistance needed *must be requested.*

Another important fact not generally realized is that an emergency must be declared to insure immediate, positive and individual assistance. Most facilities provide for emergencies; the operation of some are limited to emergencies. The important point is that the type of assistance, the speed of the operation and the priority given depends on whether the situation is an actual emergency. It is extremely important, therefore, that these facilities be advised that "This is an emergency."

Pilots must realize, too, that most of the facilities are advisory, *only;* the sole responsibility for safe conduct of a flight still rests with the pilot. He, alone, must decide whether the flight can be made or continued safely with the assistance available.

As previously stated, emergencies in flight, undeclared by pilots, have resulted in many accidents. By the same token, many were prevented because pilots declared emergencies and received assistance. With the advent of high speed and high performance aircraft, emergencies may occur in greater numbers and pilots may be exposed to greater stresses. Let's streamline our thinking and when an emergency occurs, declare it, now! ●

REX SAYS

I'LL BET the Zuni, New Mexico, range station operator has a fine sense of humor. He'd have to. Why? Because of pilots and their air-to-ground communications efforts.

I'm used to flying between Albuquerque and the West Coast. I know that when I'm using UHF, the Zuni operator can receive me and that he will return my call on 353 kc or VHF.

I can tell newcomers flying Green 4 airways everytime. They'll start calling "Zuni Radio" on UHF from the time they are over the range station until they are half-way to Winslow, Arizona, or to Albuquerque. Finally, they catch on. I can almost see them referring belatedly to the Radio Facility Chart.

Then comes a confident positive call. Immediately I switch over to 353 kc. The tired, relieved voice of the range operator politely informs the pilot that Zuni radio does not transmit on UHF.

I know there must be many Interstate Airways Communications Stations—CAA (INSACS) scattered over the States with the same type of radio equipment. I do know that there are many pilots who are attempting to communicate with ground stations that are using incorrect frequencies. All they have to do is check the Fac Chart. Other pilots may urgently need the channel that they are blithely chattering on.

REX SAYS*—Amen!*

* * *

A FRIEND OF MINE told me of this harrowing experience.

Flying in mountainous terrain is usually turbulent. This is particularly true during summer months. My friend was boring along VFR off airways in a C-47. Mountain tops in the area were 10 to 11,000 feet. No visible weather, yet the Gooney was rolling and wallowing in the up and down drafts. The rate of climb indicator resembled a trapeze artist performing on his swing.

My friend was playing it close. Topping the rock-strewn terrain by a scant 500 feet at the most.

Flying mountainous terrain is usually turbulent. ". . . and the C-47 barely staggered over crest."

Sure enough it happened. He got trapped in a downdraft which threw the aircraft out of control. He firewalled both engines, heaved back on the control column and hoped. Inexorably, the downdraft pulled him toward the mountainside. Just before it looked like he might prang, the props churned into solid air and the C-47 skimmed over the tree tops and staggered over the crest of the rugged mountain.

REX SAYS*—This sort of flying needs constant year-around surveillance. As the Fac Chart emphasizes, when over mountainous terrain, fly with that 2000-foot clearance. It's good life insurance.*

* * *

IT WORKS on 75 megacycles and you can twist its face so that it will dazzle you with its brightness or show you only a pinpoint of amber light, yet for a navigational aid, it is hard to beat a marker beacon.

You wouldn't think this innocuous looking little instrument could cause an accident, would you? Call this one the case of the One Dash—but it happened.

Flying westbound on airways and cruising at 12,000 feet, the pilot watched the ADF needle oscillate rapidly and swing definitely to a 180-degrees position. The amber marker beacon light flashed on and stayed on.

The copilot picked up the microphone and made the mandatory position report. He asked for destination weather and the latest winds aloft at 12,000 feet.

Boring on through the solid overcast, radio static and turbulence increased, as the aircraft continued on its course.

Having flown for the past five hours on instruments, both pilots were tired. Strong, shifting winds had played havoc with a constant groundspeed. One leg of the flight had resulted in a 40-knot difference due to a headwind. Twelve minutes later the audible range signal grew louder.

Suddenly the marker beacon flashed on. The copilot looked at his flight progress log. Must be the range station, can't count much on ETAs with this erratic wind.

He poked the pilot on the right arm and pointed to the amber light. Having received holding instructions from approach control to descend to 6500 feet when over this range station, the pilot retarded the throttles and started a right turn.

Five days later, a ground search party found the scattered parts of the aircraft near the top of a 11,000-foot mountain.

The fan marker transmitter was located between two mountain peaks. Its identification signal was One Dash. Did the pilot incorrectly identify the amber light signal of the fan marker for the range station signal which was 20 miles farther west?

REX SAYS*—Wind drift, erratic groundspeeds, fatigue, atmospheric conditions and probably an inaccurate check of fan marker identification signal all added up to cause this fatal accident. Know where you are!*

★ ★ ★

I'M A PILOT-WEATHER officer. Also, I'm an instructor in our base instrument school which all pilots attend before taking their annual instrument-card examination.

I have discovered that some pilots do not understand how prevailing visibility is determined.

Here's how. The prevailing visibility is that which occurs in most of the four quadrants. If visibility is two miles, three miles, four miles and five miles in each of the four quadrants, the prevailing visibility is not four miles. It's not two miles nor five miles; it's not the most visibility or the least visibility. *It is three miles because you can see at least three miles in more than half the designated quadrants.*

Thus, you could have ten miles or unlimited visibility in one quadrant and have zero zero in the other three and the forecaster is going to have to report zero zero for the station.

REX SAYS*—Well, what do you know about that? Very interesting! Let's get some more info like this in the mail. It's the finer points that separate the professional pilot from the sub-standard one.*

How many copilots are there in the Air Force? Maybe Rex would give us a boost by using this "lament."

"Just a Stooge"
(for copilots only)

I am the copilot, I sit on the right
I'm not important, just part of the flight.
I never talk back lest I have regrets,
But I have to remember what the pilot forgets.
I make out the flight plan and study the weather,
Pull up the gear and stand by to feather.
Make out the forms and do the reporting,
And fly the old crate when the pilot is courting.
I take the readings, adjust the power,
Handle the flaps, and call the tower.
I tell where we are on the darkest of nights,
And do all the work without any lights.
I call for my pilot and buy him cokes,
I always laugh at his corniest jokes.
And once in a while when his landings are rusty,
I come through with "Jove, but it's gusty."
All in all I'm a general stooge,
I sit on the right of the man I call Scrooge.
I guess you think I'm not understanding,
But maybe someday he'll give me a landing.

REX SAYS

"Call Me Scrooge"
(for pilots only)

I am a guy
Who flies in the sky
With a man on my right, all the time.

For I fly with cargo
From here to Chicago
To save the Air Force a dime.

Now this boy on my right
Who holds the flashlight
As I shoot an approach to O'Hare.

Is a guy who's a must
With a terrible lust
To fly from the left handed chair.

He thinks he's a stooge
And he calls me scrooge
Real un-understanding is he.

But if he takes the wheel
And louses the deal
For "No Supervision," they'll hang me.

"See You Tomorrow Sarge!"

Can an aircraft accident be caused by a tired, listless and foodless crew chief? Almost daily, pilots are cautioned about fatigue, but how about "chief" fatigue?

Endeavoring to explore all facets of accident prevention, FLYING SAFETY believes the letter below sums up, with a punch, (ouch!) a responsibility too often shunted aside by pilots — "housekeeping" of their crew members while on the ground. How many times have you said, "See you tomorrow, Sarge?"

★ ★ ★

Dear Editor:

Here's an article I've written that you may consider of sufficient interest to your readers to publish in a future issue. The events described actually occurred in one day. Variations of these events occur almost daily, at various bases of all USAF commands. I do not mean to detract from the excellent service and accommodations proffered at many bases but the following can — and does — happen to crew chiefs and flight engineers, be they assigned to a dependable C-47 or the mighty C-124.

The aircraft lands at an Air Force base which has a steady and quite predictable transient aircraft traffic load. The alert vehicle leads us up and down a myriad of taxiways and finally we arrive on an inactive runway, or perhaps a gravelled area, known locally as the pea patch or boondocks. It seems we are always far, far from operations, transient alert and refueling.

Immediately, a carry-all or sedan arrives to pick up three pilots, a navigator and about 25 passengers. The crew chief leaps out and asks for fuel, oil and perhaps de-icing fluid. "Be right out," is the standard answer. In about two hours the crew returns. "Ready to go, chief?" "Nope, no fuel or oil." The pilot cranks up the radio and calls the tower. The tower operator checks and says, "Be right out." About half an hour later the chief takes off for refueling with fire in his eye. While he's gone, the fuel truck shows up, but it's the wrong octane. Finally, we get off, the chief sans his chow, and by now swearing he is going to quit crewing airplanes and get a job crewing the ground-powered equipment.

About 0100 hours we arrive at another Air Force base and the refueling process is repeated. This time we are lucky. There are only a few aircraft still flying, and we finish in an hour and a half. There'll be no chow at this hour so we hunt a sack. Operations has a driver who doesn't know where the transient airmen quarters are but we finally find them. In the office there is a sign informing us to call the visiting officers' quarters for bedding. This, we do. After the phone rings for five minutes, a sleepy voice says, "Hello." We explain, and the voice states that we are to come to the VOQ (10 blocks) for bedding. We thank him and wearily go to hunt up the nearest bare mattress, put on the B-15 jacket and try to go to sleep.

The next morning, after explaining to the head checker at the mess hall that we are transients and just haven't got a chow pass for his mess hall, we go to the snack bar for coffee and a doughnut. The preflight is completed and off we go.

The moral of this story is that no one can perform his flying duties properly after such mental and physical punishment, be they watching the fuel and oil pressure as a Gooney Bird takes off or running the whole panel on a Globemaster.

These things can and do happen. They have happened to me and to other crew chiefs. Perhaps such events as have been described are why we read in FLYING SAFETY and the MAINTENANCE REVIEW of a crew chief or engineer pulling up the gear on the ground, feathering the wrong engine, or walking into a prop. I don't know.—Anonymous Crew Chief. ●

Dig Down Deep . . .

. . . and come up with enough clams for a subscription to FLYING SAFETY. If you are in any way interested in aviation, here is an opportunity to keep in touch. Whether you fly a light plane or a B-52, FLYING SAFETY has a message for you. You will get your money's worth of information. Just fill in the coupon and send it in. Oh yes, don't forget the three bucks.

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

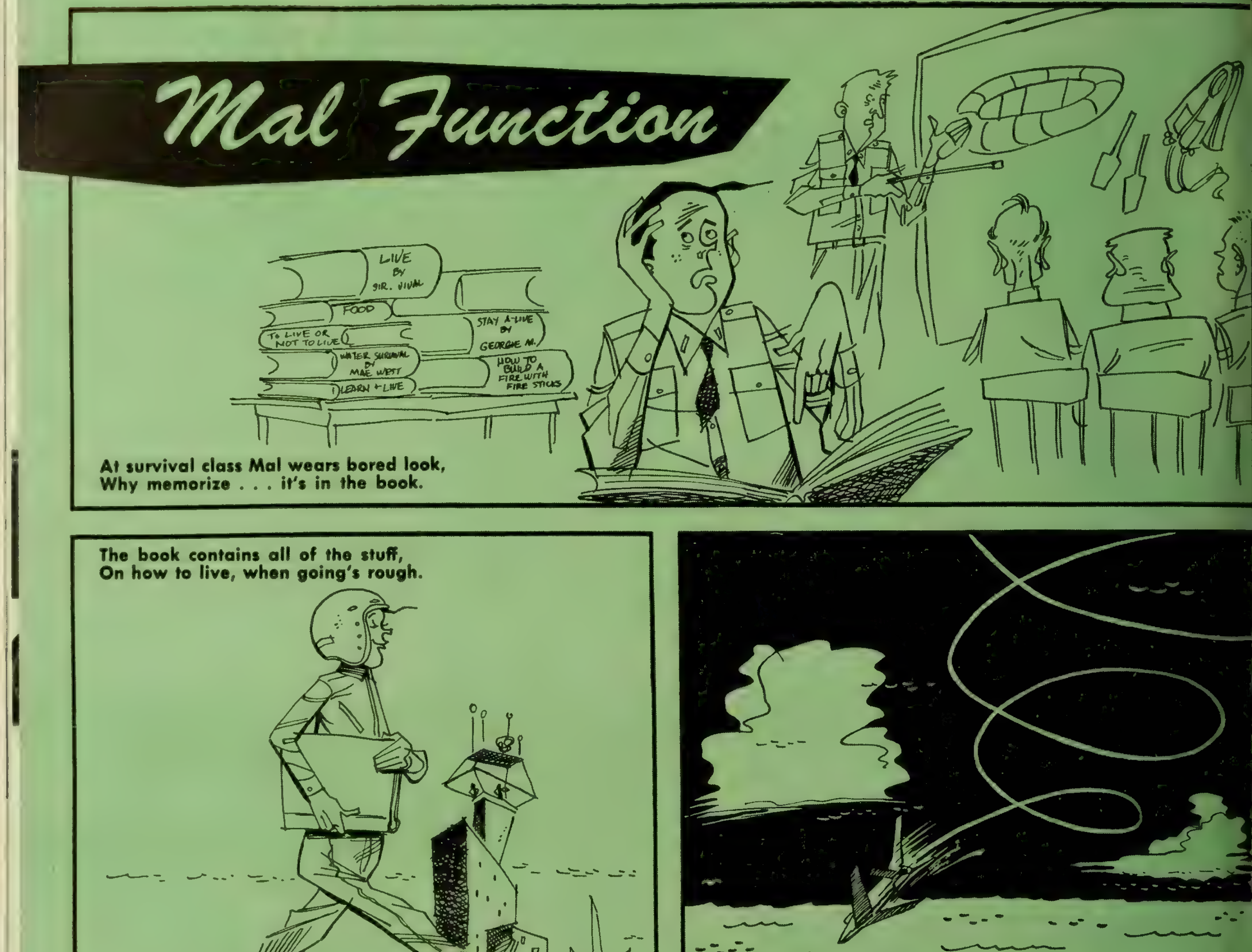
Please send *Flying Safety* Magazine for one year to the following address. Enclosed is a check or Money Order for $3.00. ($4.25 for foreign mailing.)

Name ______________________________

Address ______________________________

City ______________ Zone ______ State ______

Mal Function


LIVE BY SIR. VIVAL
FOOD
TO LIVE OR NOT TO LIVE
WATER SURVIVAL BY MAE WEST
LEARN + LIVE
STAY A-LIVE BY GEORGIE M.
HOW TO BUILD A FIRE WITH FIRE STICKS
SURVIVAL SCHOOL

At survival class Mal wears bored look,
Why memorize . . . it's in the book.

The book contains all of the stuff,
On how to live, when going's rough.

Off in the blue our hero blows,
But not for long, so down he goes.

In black of night our boy's insane,
As for the book, he looks in vain.

But that's one thing he'll never see,
As fish read on "Survivalry."

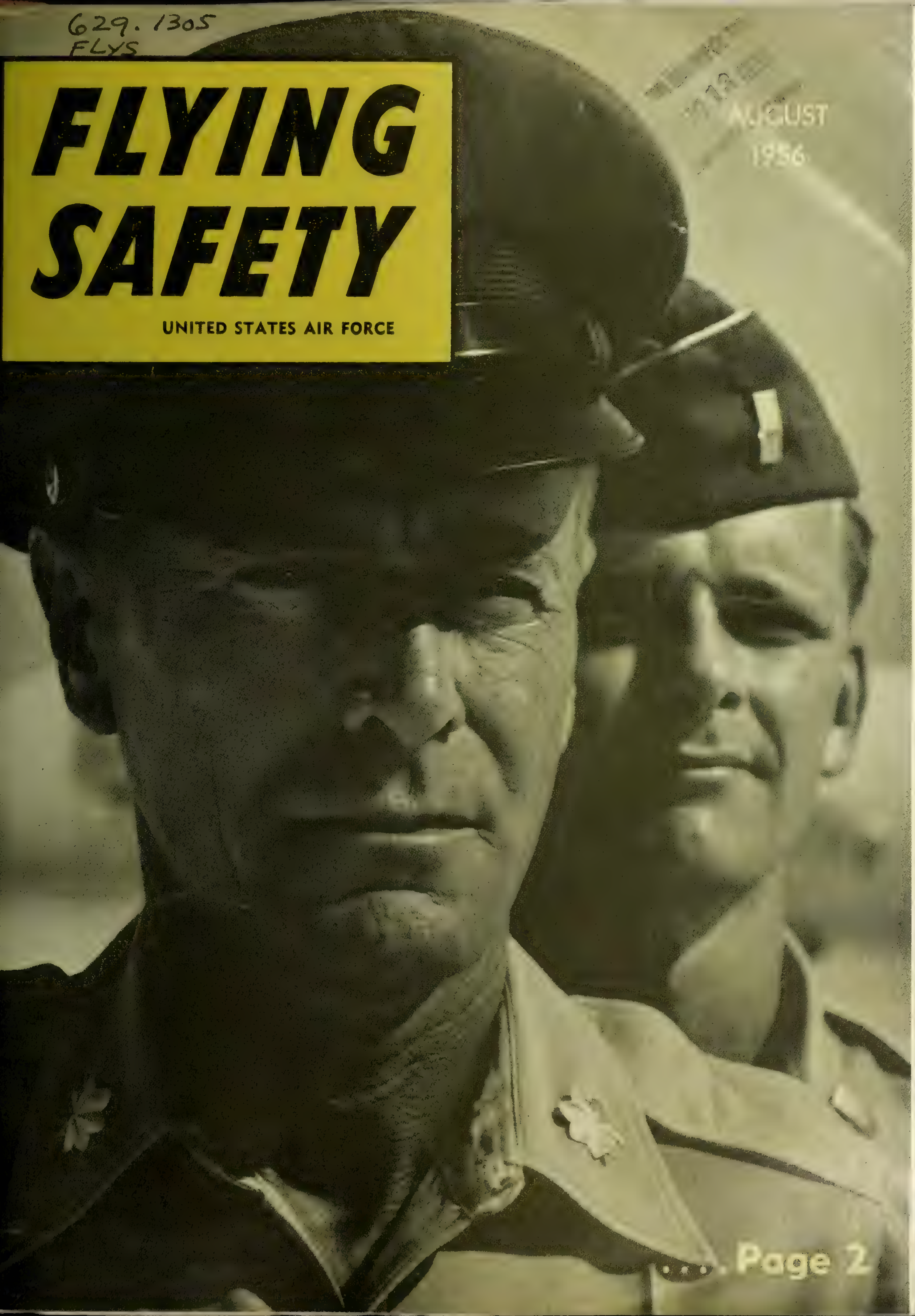
*U. S. GOVERNMENT PRINTING OFFICE . . . 362336

629.1305
FLYS

FLYING SAFETY

UNITED STATES AIR FORCE

AUGUST
1956



. . . . Page 2

FLYING SAFETY

VOL. TWELVE NO. EIGHT

File Thirteen

This is the first "File 13" column and you may well ask the question, "What's your point?"

In a word or three, our object is to bring to you some of the flying safety information which is not adaptable to feature articles. (That's one way of saying, "Herein will appear all of the cats and dogs that hit my desk, get the ten-second stare treatment, then proceed on to File 13.")

True, I fly an LSD (large, steel desk) an awful lot, but this job of mine inherently attracts late info from the boys who know. This, I hope to pass on to you through this column. So-o-o-o, leave us get on with it.

★

. . . There is a change coming up in AFR 60-16 that will require pilots to file IFR when on top of a cloud cover of 6/10 or more. All of the new 60-16 revisions will be reviewed in FLYING SAFETY soon. . . . Just received word of what I believe is the first successful landing barrier engagement with an F-100C equipped with drop tanks. It occurred at Wendover AFB (that's in Utah, sir), and he hit the net doing about 75 knots. . . . Then there's the actual account of the Navy airman who reported that the voice tube he found under the seat was out of order. He couldn't talk to the pilot through it.

So long 'til September. . . .

Perry J. Dahl

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major Jesse F. Townshend, Jr.

Associate Editor
Major V. R. Stutts

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby
T/Sgt. Chester McCubbin
T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune
A/2C Al Fagerwick
T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

Don't Get Too Familiar 2
From the Ground Up 6
Yak-Yak-Yak 12
Keep Current 14
Speak! 16
Well Done 19
Runway Check Point 20
The Forward Look 24
Rex Says 26
No Strange Fields 28

★ ★ ★

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $3.00 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

The printing of this publication has been approved by the Director of the Bureau of the Budget, July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

LETTERS TO THE EDITOR

Beacon Letters

This refers to the Letters to Editors, FLYING SAFETY, May 1956, titled: "Jolly Well."

A solution for IFR identification of airfields is a 75 mcs marker beacon at each airport with the beacon coded by the letter identifiers of the airfield. This will require no aircraft modification and can be shown in the Radio Facility Chart very easily.

I will expect my free subscription of FLYING SAFETY and will keep you advised of my change of address.

Capt. Ralph S. Hoggatt
605th Tac Control Sq
APO San Francisco, Calif

And there you are!

★ ★ ★

Emergency Landings

The Australian Department of Air has read with interest the February 1956 issue of the USAF Magazine, FLYING SAFETY, and in particular an article under the title of "Down, Boy, Down!" which indicates that the USAF has recommended that in the event of a crash landing on unprepared surfaces the undercarriage should be selected down and locked.

This article states, "As a result of this study, all fighter Flight Handbooks, excluding the one on the F-89, are now being revised." In addition, "Further research projects have been initiated to see whether the same recommendation can be made for forced landings on bombers, transports and trainer aircraft."

This is a radical change in policy and the Australian Department of Air is extremely interested in this departure from long adopted practice and therefore it would be greatly appreciated if this office would be given full details of the studies together with any further information and further recommendations in respect to multi-engine aircraft or single engine aircraft in the bomber, transport and trainer category.

J. R. Lavers
Wing Commander for Air Attache
Royal Australian Air Force

The complete study of Jet Fighter Forced Landings on Unprepared Surfaces is en route. Glad to be of service to our friends from Down Under.

★ ★ ★

Nice Words from the RAF

I have the honour to request your permission to reproduce the article "Bouncing Thru the Boondocks" from the March 1956 issue of your magazine FLYING SAFETY. We would like to use it for our own publication, the *Flying Safety Bulletin*, which is intended as a wall poster for Royal Air Force Transport Command stations and units. If your permission is granted we will include of course a suitable acknowledgment to the source of the article.

Our experience has shown that undershoots form the major part of accidents attributed to that overworked and much maligned factor "pilot error." We are endeavouring to reduce these unfortunate mishaps by all the means at our disposal, and on reading this article we found it to be ideal material for our needs.

May I compliment you on producing a most excellent magazine which is read here with great interest. We obviously have many troubles in common in our respective campaigns against broken aeroplanes and your ideas and advice are a great help.

Sq Ldr K. B. McGlashan
Hq Transport Command
Royal Air Force

It's a privilege to grant you permission to reprint the article, and thanks for the kind words about our magazine. Nice to know that we're of some help to you in your broken airplane department.

★ ★ ★

To Further Flying Safety

The speed control described in the April issue of *Flying Safety Magazine* seems to be a great advancement in instrumentation. However, I believe the words "Increase Speed" and "Decrease Speed" applied to the dial in place of the current "Slow" and "Fast" would be an important, additional safety factor.

Some of our pilots pass a half a dozen school zone signs each day, going to and from the base. A sign reading "Slow, School Zone" develops in the pilot a conditioned reflex to reduce speed a half a dozen times a day at the sight of the word "Slow."

Therefore, I believe, especially where pilot fatigue is concerned, the words "Increase Speed" and "Decrease Speed" might put us a little farther along the road of flying safety.

M/Sgt Carl V. Shrader
3320th Fld Maint Sq
Amarillo AFB, Texas

Thanks. The farther along that road we can get, the better. Your suggestion has been forwarded to the manufacturer of the instrument. Recently, FLYING SAFETY has been receiving more and more letters with flight safety suggestions. Keep 'em coming!

Don't Get

So you are an old hand. So you have lots of time in the bird you're flying. So you have held a green card for years. So familiarity breeds contempt.

WHENEVER DISCUSSION rolls around to the subject of pilot error, the general tendency is to consider this a problem of the young sports, the fledglings. We visualize aviation cadets groundlooping, spinning in, doing all manner of hairy things with airplanes. We take the view, frequently voiced, that if a pilot survives his first year of active duty, he's got it made!

The corrective action we propose usually centers around the training program, instruction, care and feeding of the young birdman. Of course this is all very fine, as long as we don't wear blinders. The new lads commit errors aplenty, it's true, but they have lots of company. The old grizzled veterans can and do botch things up beautifully too, and they,

TOO Familiar!

Lt. Col. Mitchell J. Mulholland
Safety Research and Analysis Div., D/FSR

dear friends, are the people we intend to talk about today.

This is not going to be idle chatter either, because we all consider ourselves experienced pilots and that adds up to a lot of people. The most disastrous accident in point of lives lost in the history of aviation happened to a pilot with 7000 hours. One hundred twenty-eight people met their Maker along with him when their C-124 spun in near Tokyo. It was an experienced Lieutenant Colonel who flew his B-25 into the Empire State Building and another field grade pilot who ran his C-45 into the Bank of the Manhattan Company on Wall Street, between them netting the Air Force some of its most spectacular headlines. We are continually confronted with gross errors committed by people who, we say, should have known better. Sure, maybe they should have, but either they didn't know better (why not?) or something slipped somewhere (what?).

Let's look around us first. This problem is obviously not peculiar to the flying business. How many hours have you logged behind the wheel of an automobile? And yet can you honestly admit you make no errors in that department? Never run out of gas? Never pass a stop sign? Never have a close call? How about the engineer on the Santa Fe's San Diegan? Thirty-seven years of railroading and he took a curve so fast the train fell off the track. These things shouldn't happen, but they do. Who remembers the airliner that crashed on takeoff at Copenhagen a few years back? A senior airline pilot with oodles of hours took off with the control locks on. The oldest booby trap in the books and it caught a wise old bird.

There's an old saying that familiarity breeds contempt. If you've lived with danger for a long time, you tend to reach a point where you no longer recognize the danger. Danger is danger, whether it's exemplified by a sleeping lion, a dormant volcano or a smoothly purring aircraft. No matter how long you've lived with it, it can kill you just as dead as it could if you'd never seen it before.

The first time you fly a new aircraft you treat it with healthy respect. As you put in more time in the beast, you learn more about what it can do, you feel more at home in it. So far so good. But when you reach a point where the airplane fits you like an old shoe, look out! When you lose respect for an airplane it's just like playing with a loaded gun. The people who have been killed in Gooney birds are every bit as dead as those who got it in F-100s. The bird can clobber you just as effectively whether you have two hours or two thousand hours in it. So don't sell any airplane short. An airplane is a machine that defies gravity, and gravity doesn't care what kind of a bird it is. What goes up must come down, including the crew.

Safe Airplanes

Now wherein do we find ourselves losing respect for our aircraft? The most logical place to look first would be the accidents involving our old trusted "safe" airplanes, the C-47, C-54, B-25 and C-45. These are the planes that everybody knows and flies, the traditional old workhorses that we use for any old cat-and-dog mission. Barring out-and-out materiel failure, these old birds just should not have accidents. What do we find? Simply some of the goriest crashes on record. A C-47 splattered against the face of an Arizona mountain. Ditto for a C-54 on Mount Charleston, Nevada. Another in Formosa. In fact there's hardly a self-respecting Alp that doesn't have a Gooney bird draped over it somewhere. It's admittedly hard to clobber these old stalwarts but in an argument with a mountain, any airplane comes off second best. So it's rather amazing how many old hands still try to knock holes through mountains with Gooney birds.

Sometimes it seems as though pilots analyze a "safe" airplane to find out just how it *can* be cracked up, and then proceed to do it. The C-45 will do a pretty little arabesque off the side of the runway if you encourage it. So people do, and look very silly doing it. If you try hard enough you can nose up a C-47 by running up both engines to full power in a tailwind. So people do it. Even a B-25 doesn't do too well on one engine if you slow it down below 145 miles per

If you encourage it, the "safe" C-45 will do a very pretty arabesque off the runway.

hour. But people do it. It seems about the only way to wreck a C-54 is to hit a mountain with it, so failing everything else, people do that. WHY?

Do we look for the answer in sheer carelessness? As a pilot gets older, bewifed and childrenized, he should be more mellowed, more cautious. Do we look for it in declining proficiency? Hardly, in view of the background of experience in most of these pilots. Physical fitness? Senile decay? Look, we're talking about people in their 30s for the most part. No, it's something much more basic. Familiarity breeds contempt, we say. Let's see how it operates.

We have all heard the time-honored cliches, the "famous last words" of the flying business, such as

"Oh heck, it'll burn off by ten o'clock."

Oh heck, we can get through with this airplane."

"Oh heck, B-25s always smell that way."

"Oh heck, it's probably just the gage."

"Oh heck, it's my home base—we can get in."

OR

"Never mind, GCA, we're VFR."

What do all of these gay remarks have in common? Mainly the fact that they all have the ring of experience about them. They come, not from the mouths of babes but from the lips of the old bold boys who nonchalantly light a Murad as they bore holes through the murk.

It's the old hand who watches his fuel gages bounce on the bottom, coolly examines his fingernails and says, "The gages are way off in this airplane—we've got a good two hours gas left." It's the old hand who jaunts off across the high Sierras with no more preparation than he would make for a trip to the drugstore. Maps? Too clumsy. There's a Fac Chart in the airplane. Is there? He doesn't look for one until he's levelled off on top of the overcast, settled the mixtures in cruising lean and asked, "Chief, how's the coffee?"

Flight planning? Sure, he believes in it, but he's not going on a flight. He's just driving a Gooney bird to Great Falls.

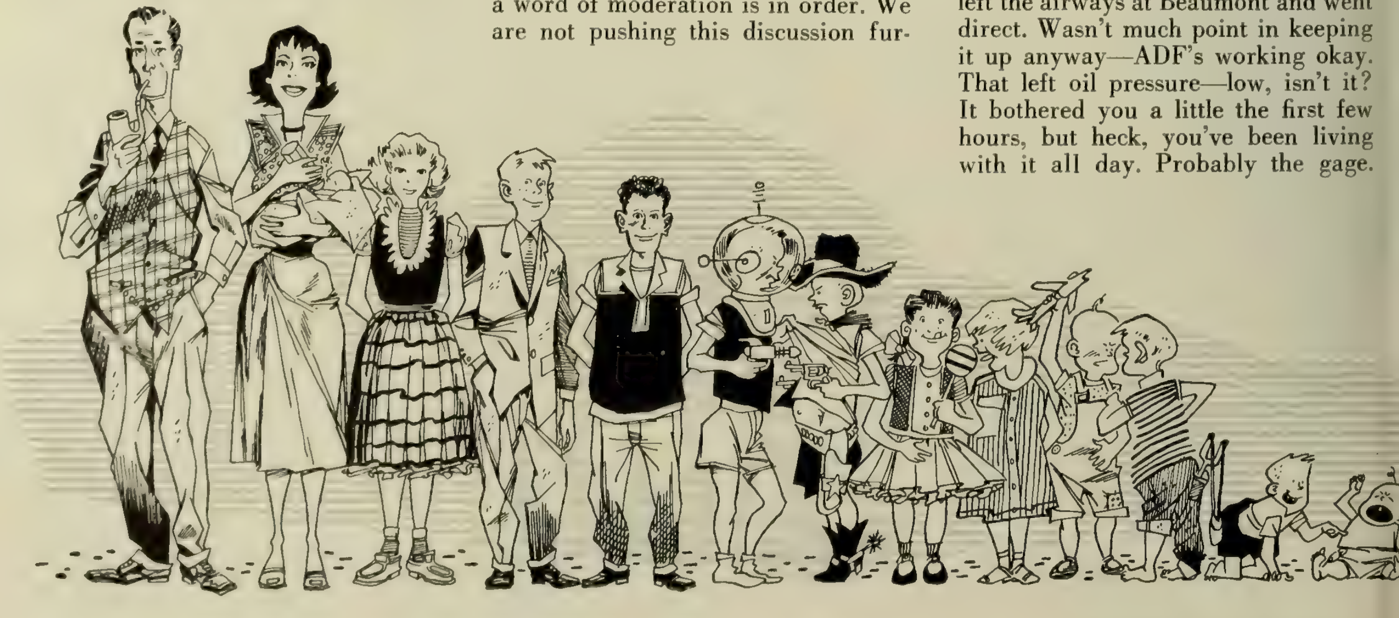
Old Dependable

Before anybody pipes up and says, "That's not *me* you're talking about!", a word of moderation is in order. We are not pushing this discussion further than the realm of our everyday pilots. We are not going to dwell on the follies of the hare-brained extrovert who shows off his familiarity by flying through hangars upside down saying, "Look! no hands!" Leave him to heaven. We are talking about the old commonplace pilot, the type with a wife and a short stack of kids, the old dependable eight to five gent who flies for the long green. It's not a glamorous business any more to this pilot. He probably couldn't care less if he never saw Daggett, Needles, Prescott, Winslow or Zuni again, but he'd rather see them from the air at 200 mph than on the ground at 60. He is long past the stage of slipping the surly bonds of earth, and dancing the sky on laughter-silver'd wings. (Would look kind of silly in a Gooney bird, anyway.) The meat of the matter is that he has reached a danger point and doesn't know it. The danger is boredom.

A Hazard

Yes, I said boredom. If you don't think it's a hazard, just try this sometime for size: Take an old familiar airplane, an "old shoe," take off about 9 in the morning from somewhere in the East, and fly west all day long in CAVU weather, with maybe a little haze. I'll be back around 1630 and ask you what you think about boredom. Just take that map down off the windshield—the one you're using for a sunshade, empty that overloaded ashtray, take that headset off and rub the pain off your earlobes, and tell me all about it. Look at the nice flight log you were keeping until you left the airways at Beaumont and went direct. Wasn't much point in keeping it up anyway—ADF's working okay. That left oil pressure—low, isn't it? It bothered you a little the first few hours, but heck, you've been living with it all day. Probably the gage.

We're talking about the eight to five gent, the one with a wife and short stack of kids.



A bored pilot is hardly in the best shape to meet an emergency. It's an occupational hazard.

That's what the engineer said too. Of course the idea of digging into that engine at your last gas stop didn't appeal to him either. Looked like a heck of a place to be stuck with an AOCP. Especially when you're figuring on an RON in El Paso. What's that station you passed? Wink. Appropriate isn't it? 1630 on a hot, sunny afternoon. Winken, Blinken & Nod. Get some music on the radio compass. No coffee left in the jug. Mouth tastes like an old ashtray. Gad, there's an awful lot of Texas.

Now—what were we saying about boredom? Granted that the type of situation described probably has not directly caused many accidents, but it's a symptom. A bored crew is hardly in the best shape to meet an emergency. The bored pilot tends more and more to take little things for granted, to overlook little discrepancies, to discount danger signs. When the payoff comes he's not ready; he's caught by surprise. It's the bored crew that cuts corners, skimps on preflight inspections, takes short cuts to get the show on the road. Why? Not because they are intentionally negligent. It's just that they've gone through this whole thing so many times that it's an old routine. Everything has been okay in the past; all the extra precautions and checks seem a little silly and unnecessary. And this attitude grows and grows, particularly with a safe old airplane. The old bird grinds along uncomplainingly for so long that we can't picture anything going wrong. The airplane's reputation becomes legendary and people start sticking their necks out for trouble. Years ago it used to be said about the B-18 that it took talent to crack one up and positive genius to hurt yourself in one. But people did both. And they weren't geniuses either. They just forgot that even a B-18 had to be *flown.*

Here we have rambled on about the old Model T's and Mack trucks. What about the jets? Experienced pilots are flying them too. Well, they're doing exactly the same things and for the same reasons. The situation may not appear as extreme, mainly because the jet is newer, faster and doesn't take so infernally long to get somewhere. On the other hand though, it is not nearly so forgiving of mistakes or inattention. It does not like to be taken lightly. So when a pilot reaches the point where he knows the F-86 like the back of his hand, there's all the more reason for him to take care when he flies it. The human mechanisms of adjustment and familiarity work exactly the same in any airplane, and all airplanes are essentially the same kind of beast. It's just that things happen a lot faster in the jet, so the pilot has to plan a lot farther ahead of it.

Don't lose sight of the tremendous adaptability of the human being. He can get used to almost anything. Remember Clyde Beatty in the lion cage? Bullfighters, prizefighters, firefighters, or old GI Joe in the front line foxhole, all exemplify the capacity to adjust to extremely hazardous situations.

Flying an airplane, *any* airplane, is not as alarming an occupation as some of these other pursuits. An airplane doesn't growl and make ugly faces at you all the time. In fact, most of the time it's cooperative and pleasant. But when things go bad, the outlook gets bleak in a hurry. So just because you've gotten used to the job, just because you're experienced and it's all an old story, don't let yourself think that the danger isn't there any more. It's there all right—you're just used to living with it.

The Moral

What's the moral of the tale? The pilot doesn't live who is so old or so bold that he can afford to lose respect for his equipment. Take that any way you want—he doesn't live. There's an obvious corollary in this for commanders. The old hands can't be left free of supervision just by virtue of their flying time. Their knowledge and technique have grown with experience, but there are still a lot of imponderables that affect the flying business. Their morale, alertness, prudence, discipline and plain horsesense are factors that the commander must be aware of. They are grown up men, it's true, but the C.O. is still responsible for the way they do their individual job.

Once again consider the airline pilot—he sees the same route a hundred times for every one time the average Air Force jockey sees it. If he lets boredom get him he'll be washed up in a hurry. Discipline and professionalism are the watchwords—it's up to all of us to see that we uphold them in all of our operations. ●

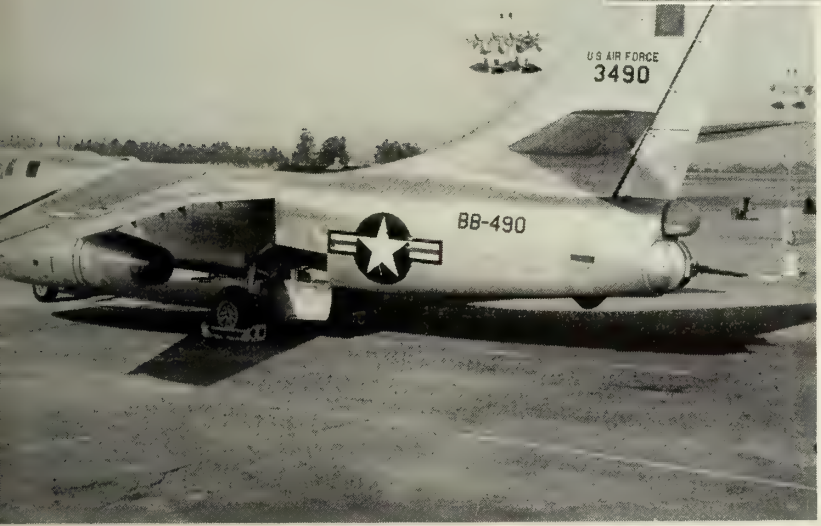
B-66 from the ground up

Frank O. Boyer
Douglas Aircraft Company

Here is an article on the latest edition to Uncle Sam's air arm, the versatile B-66. This story was prepared especially for FLYING SAFETY by a veteran Douglas test pilot.

WITH PRODUCTION rolling, many more B-66s will be appearing on the flight line. Since some of you may soon be strapping one securely in place, it might be timely to talk about some of its flying characteristics.

The B-66, like all new complex weapons systems, has had its share of growing pains. A lot of experimental flying had to be done to develop satisfactory characteristics. Initial developmental effort resulted in an excellent hydraulically boosted control system, but buffet became evident and had to be eliminated. Extensive flutter investigation was necessary to insure safe and satisfactory low altitude, high speed performance. Complex electronic accessory equipment gave even the geniuses a few headaches for a while.



The B-66, like all new complex weapons systems, had a lot of experimental flying before it was operational. It is now a bird you will like to fly.

Fortunately, these problems have been corrected to everybody's satisfaction and the B-66 is now a weapons system ready for operation. However, we will be concerned here with general characteristics and operating procedures, since mission profiles and performance data still are classified.

The J-71-11 engines are working out very well. Flight tests have demonstrated that when properly adjusted, they are meeting thrust guarantees and acceleration characteristics are greatly improved. However, idle thrust might be considered a little high, resulting in high unbraked taxi ground speeds.

In normal operation, the rudder-elevator boost system is supplied by a hydraulic pump mounted on the right engine. The aileron boost and spoiler systems are supplied by a pump on the left engine. In the event of engine failure, the systems are automatically interconnected as the failed engine RPM drops below 41 per cent, thus precluding the possibility of loss of control system boost during single engine operation. The utility and emergency hydraulic systems are similarly interconnected.

The fuel supply is furnished from two fuselage and two wingtanks. Prescheduled fuel levels are automatically maintained in the fore and aft fuselage tanks to eliminate center of gravity (CG) shift. Proper levels also are maintained automatically during wingtank fuel transfer. In the event of failure of the automatic CG control, manual override is provided and fuel schedules should be monitored.

As in all aircraft, safe flight begins with good planning. Particular attention should be given to takeoff conditions. We cannot over-emphasize the importance of knowing minimum runway lengths, maximum refusal speeds, minimum single engine control speeds and best single engine climb speed for various flight conditions that may be encountered in tactical operations. The habit of giving the airplane the once over prior to leaping into the blue is as ageless and necessary as flying speed is to flight. All in all, these items add up to peace of mind and confidence.

Entrance to the aircraft is gained through a hatch on the underside of the aircraft. A ladder is an integral part of the hatch door and no special stands are required. The navigator and gunner have easy access to their stations. The passageway to the pilot's position is narrow and there is a fairly tight squeeze into the cockpit. Once seated, the controls, switches and knobs are readily accessible and logically located.

Handling Characteristics

Ground handling is very good. Nosewheel steering is accomplished by a two-ratio hydraulic system actuated by rudder pedal deflection. Directional control is positive and pedal forces are light. Wheel brakes are effective but heat dissipation is marginal. As is the case with most high performance aircraft, prolonged, excessive use of the brakes can result in an overheat condition.

The flight characteristics of this aircraft make it unusually easy to fly

The aircraft is built fairly close to the ground and entrance can be made through a hatch on the under-side of the fuselage. Below, the starting unit is hooked to a single point receptacle.

and no special techniques are required. During takeoff, directional control is maintained by using rudder pedal steering. Because of the narrow landing gear, the aircraft has a tendency to bicycle (turn toward the direction of wing roll) during high speed ground operation. As a consequence, a wings-level condition must be maintained during the takeoff ground run by use of ailerons.

In a crosswind, the upwind wing tends to rise, resulting in a tendency for the aircraft to turn downwind. Though nosewheel steering is sufficiently powerful to maintain directional control, the aircraft leans downwind until sufficient speed is gained for the ailerons to take effect.

The aircraft may be rotated to a takeoff attitude approximately 15 knots below lift-off speed and then allowed to become airborne as takeoff speed is attained. Some pilots prefer to leave the nosewheel on the ground until flight speed is attained and then lift the aircraft off. This technique has the advantage of better directional control through rudder pedal steering in the event of an engine failure while the aircraft is still on the ground. Also, it minimizes drag until flight speed is attained. Under aft CG conditions, the airplane has a tendency to pitch up slightly as it becomes airborne if the nose is lifted too early or if too much nose-up trim is used.

Airborne

Once flight is attained, the gear may be retracted immediately without experiencing a trim change. During flap retraction and under normal operational gross weights, the aircraft accelerates sufficiently well to prevent any sinking. During climb the aircraft attitude is relatively nose-low,

allowing good forward visibility. To achieve maximum performance, the climb schedule should be strictly observed. Above 30,000 feet, a variance of the climb schedule as much as 15 knots, indicated airspeed, can result in considerable loss of rate of climb.

Because of the excellent warning characteristics there is little danger of stalling unintentionally. With gear and flaps up, stall warning is generally 15 to 20 knots above stalling speed, and the buffet becomes so severe at or near the stall that most pilots avoid stalling the aircraft in this configuration. The aircraft responds well to all controls throughout approach to stall. As the aircraft stalls, the nose drops slightly with no tendency to roll. Stall recovery may be accomplished merely by releasing back pressure on the control column. With the gear and flaps extended, the aircraft has about the same stall warning. Buffet intensity is much lower than in the clean configuration and warning occurs approximately 10 knots above the stall. Again as the aircraft stalls the nose drops through slightly without wing roll off. If the pilot inadvertently enters the stall in a yaw condition, the aircraft will have a tendency to roll off in this direction. However, sufficient aileron and rudder control exists to correct this condition and again stall recovery may be accomplished by releasing back pressure on the control column. It might be noted that in this configuration if the stall condition is continued, a longitudinal oscillation can occur, and if continued, the amplitude will increase. Therefore, the stall should not be continued through this kind of condition.

Since all performance data are classified, security will not allow mentioning specific Mach numbers but a résumé of the high Mach characteristics is made below, describing them in the same order as they occur.

As Mach number is increased above maximum level flight speed, a slight buffet occurs. As Mach number is fur-

The aircraft may be rotated to takeoff attitude 15 knots below lift-off speed. With Jato it accelerates rapidly with no control problems. Gear retraction causes no apparent change in the trim.

Nosewheel steering is accomplished through rudder pedal deflection.

The B-66 is a stable aircraft with good control responses. It is equipped with in-flight refueling facilities for increased range.

ther increased, the buffet intensity increases and then levels off at a moderate buffet level. As Mach number continues to increase, a slight wing roll-off occurs but lateral control is adequate and wings level flight can be maintained easily. This trim change disappears with a further increase in Mach number. Shortly thereafter, the aircraft experiences a very slight tuck or pitch-down trim change. This characteristic is so slight that it is seldom detected by the pilot. No other trim changes occur and the buffet disappears completely as the Mach number is increased. Throughout this Mach region, there is adequate aircraft response to all controls. Elevator effectiveness begins to deteriorate very soon after Mach buffet occurs but at the highest Mach numbers flown to date, there is sufficient effectiveness to adequately control the aircraft without difficulty.

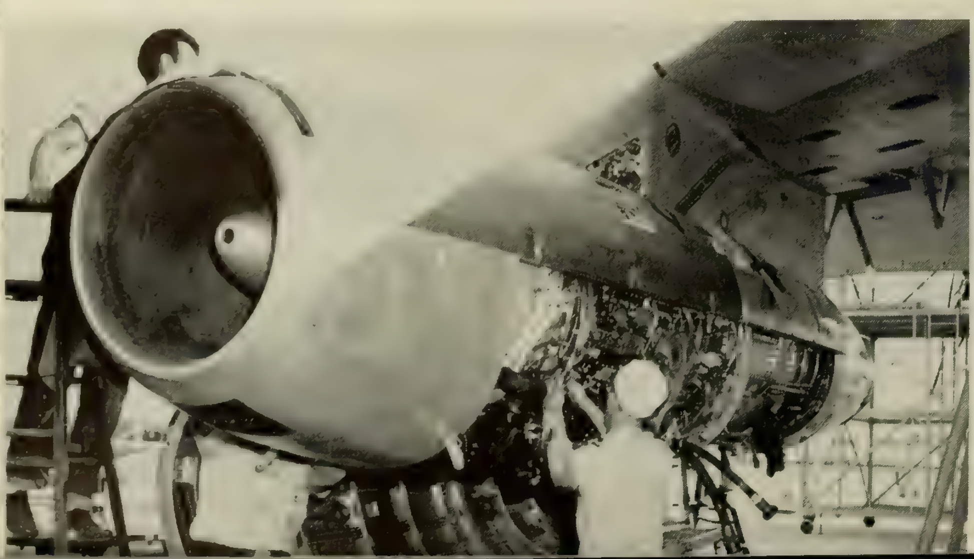
The B-66 has the capabilities of satisfying requirements for low altitude high-speed bombing missions. The relatively low control forces as well as the excellent aircraft response at high indicated speeds, result in a very maneuverable aircraft considering the size and weight involved. Because of the light control forces, there may be some concern that structural limits of the aircraft may be exceeded. To assist the pilot in observing the structural limits, a boost cut-off device has been installed in the control systems to prevent excessive control deflections. There are areas of flight wherein these devices do not necessarily protect the aircraft structure and as a consequence, the pilot should be thoroughly familiar with these limits. Although an increase in speed causes the control forces to increase, a pilot should experience no difficulty in performing various maneuvers under these high speed conditions. Rate of roll does decrease at the high indicated airspeeds because of the low deflection limits of the ailerons. Even so, the rates of roll are adequate to perform evasive tactics and maneuvers. Generally, the maneuvering characteristics of the B-66 are no different than most other high speed swept-wing aircraft. As G forces are increased under maneuvering conditions, the aircraft begins to buffet long before stall occurs.

Speed Brakes

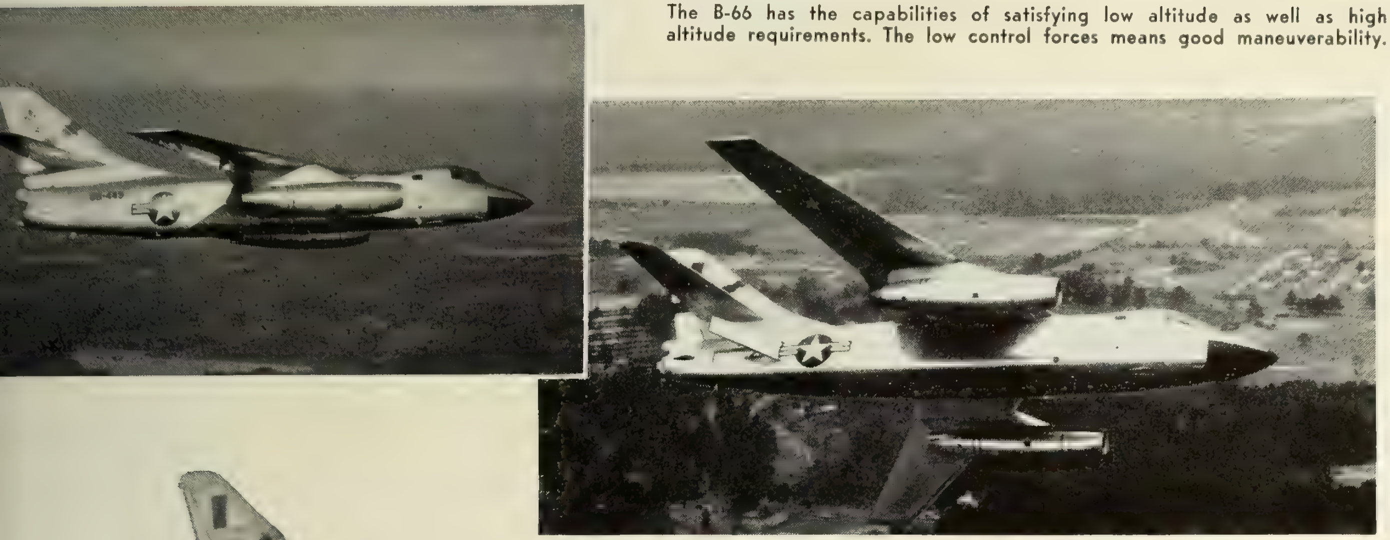
Speed brakes are very effective, especially at high speeds. When the speed brakes are extended, a slight pitch-up is experienced, but this is easily controlled. During the final approach to landing, the speed brakes are naturally less effective, but they do assist in slowing the aircraft for touchdown. Occasionally, when the speed brakes are retracted, there is a slight yawing tendency caused by one brake closing before the other. This condition is caused by the actuating cylinders for the two speed brakes being located nearer one brake than the other. The condition, though hardly desirable, presents no problem and is easily controlled.

Consistently good landings can be made in this aircraft by use of normal landing techniques. Either the normal 360-degrees overhead or the

The J-71-11 engines are meeting the thrust guarantees. Low slung, they are readily accessible.



The B-66 has the capabilities of satisfying low altitude as well as high altitude requirements. The low control forces means good maneuverability.



Consistently good landings can be made by use of normal landing techniques. Drag chute reduces the landing roll.

normal horizontal traffic pattern may be used. For the initial entry, a reasonable speed is 250 knots. At the point of break, extend the speed brakes and set the power to approximately 85 per cent. The gear and flaps may be extended as soon as the aircraft decelerates to the limit speeds. If a downwind and base leg are used, the speed brakes should be retracted until on the final approach. If, however, the pattern is relatively close in, the speed brakes may be left out. If the yaw damper is off during the landing, a lateral directional oscillation may occur especially under turbulent air conditions. Although the condition is somewhat disconcerting, pilots should have no control difficulties. The transition from approach to touchdown is normal. Stall warning buffet occurs long before the stall and the aircraft has sufficient control in stall warning buffet to accomplish a smooth ground contact. After touchdown the nose gear should be lowered for directional control through the rudder pedal steering. This is especially true during high performance landings when the drag chute is to be actuated and deployed.

Cross Winds

The airplane has been landed successfully in a 30-knot, 90-degrees crosswind. The wing-down technique is recommended to kill drift. If crosswind conditions are sufficiently adverse, the airplane may be landed on one main wheel with the upwind wing low. After touchdown, because of the narrow gear, the airplane has a natural tendency to lean downwind. This may be counteracted by the use of aileron into the wind during the landing roll. As with other aircraft, caution should be exercised when the drag chute is used under crosswind conditions due to the weather-cocking moment. Excellent short landing performance may be achieved by use of maximum braking with anti-skid and early drag chute deployment after touchdown.

Since the B-66 is a complex weapons system, efforts have been made to relieve the necessity of constant pilot attention, wherever possible. With all systems operating normally, the pilot has only to monitor the systems and can direct his attention toward mission accomplishment. Although the B-66 is a "big hunk of responsibility" for one pilot, the straight forward flying characteristics and automatic features make it a *pilot's* airplane as well as a potent addition to Uncle's growing air arm. ●

AK-YAK-YAK-YAK-YAK-YAK

It is the finer points that separate the professional from the "Form 14 looking for a place to happen" type of pilot. Next time out, why not do it the right way.

DO YOU FLY a mahogany bomber most of the time? Are you a CRT pilot? If so, the odds are that you will probably read about yourself in this article. If you are a line pilot, the odds are that you can pick up some pointers.

When taxiing out, do you use the phrase, "Request takeoff instructions?" It is much better to say, "Blank Tower, Air Force 12345, taxi clearance, instruments (or VFR) to (Destination)." This clues the tower operator in on who you are and where you are going.

To avoid clearance mixups and repeats, copy the clearance as it is received, using an approved code system. (Check page 156, Supplementary Flight Information Document for symbols of abbreviation.) It helps also to refer to the duplicate copy of the Form 175 while acknowledging your route. And instead of berating the tower operator for relaying a cruise altitude of 14,000 feet, simply advise that you cannot accept any altitude above (whatever you specify) and request an amended clearance.

With today's overburdened Air Traffic Control system, every possible effort should be made to minimize air communications. Logically, then, reducing the excessive amount of chatter would benefit every user. Here are some examples:

It is not necessary to call the tower for permission to leave tower frequency or to advise that you are doing so. Nor is there any particular hurry in leaving this frequency until you have established your climb and are on course, unless clearance instructions specify an immediate call to a control agency on another frequency. If an emergency develops shortly after takeoff, you are in a better position to return to the field safely if you have not left the control tower frequency.

Another common source of lengthy yakking is the acknowledgment of information or instructions from approach control. Repeat only enough to satisfy the controller that you completely understand. It is not necessary to repeat back the entire clearance in total. For instance, if you are holding at 3500 feet, and receive instructions to "descend to 2500," just say, "Roger, leaving 3500 for 2500."

And still another opportunity to reduce transmission time is on an altitude change request. Instead of saying, "Request that I be granted permission to descend to 6000 feet," why not use the approved "Request 6000. Can descend VFR." Many times the control agency can approve a lower altitude if you can get through an intermediate altitude by flying VFR.

An almost universal habit of using ADF to fly airways exclusively, seems to characterize so many CRT pilots. Unfortunately, many who fly from station to station on the ARN-6 have not learned the techniques or importance of ADF tracking. Consequently, some attempts at homing, while contending with strong crosswinds, may result in erratic flight paths over the ground. Conceivably a pilot can end up on the left side of a low frequency airway, not realizing that ATC may occasionally allow traffic from the opposite direction to pass through his altitude, by climbing or descending "well to the right of the on-course."

Relying on the ARN-6 aural signal while flying the "automatic" position is poor technique. The aural signal is not entirely reliable on "automatic," because the weaker signal is repelled. The frequency for best range reception or readability is slightly different than for best ADF reception. This is

AK-YAK-YAK-YAK-YAK-YAK-YA

because the center transmitter tower, which is the one that you tune in for simultaneous broadcast and ADF reception, transmits on the station's assigned frequency. (This is shown in the Radio Facility Chart.) The four towers which transmit the A and N signals actually transmit 1.02 kc higher than the assigned frequency. So, if you insist on using ADF, guard the aural signal on another receiver.

A normal position report should offer no difficulty to any pilot. The accepted procedure is to make the initial call and, when acknowledged by the ground agency, follow the prescribed position report form in the Radio Facility Chart. "Shreveport two four, nine thousand, instrument flight plan, Monroe four nine, Jackson." No more—no less. It is desirable to guard also the range frequency when establishing contact. Then if your receiver is inoperative or the station called has VHF/UHF transmitter difficulties, the operator will transmit on LF, assuming that you are guarding this frequency.

It is often unnecessary to request the "latest weather" at some nearby destination. A complete, weather coverage is broadcast at 15 and 45 minutes *after* the hour by almost every range station in the United States. The 45 minutes-after-the-hour weather is brand new. It is an "area" broadcast consisting of weather reports from stations within approximately 150 miles of the broadcasting station. The 15 minutes weather is just over one half hour old. It is an "airway" broadcast consisting of weather reports from important terminals located on airways within approximately 400 miles of the broadcasting station. If you have received a report, remember that the next observation normally will not be taken until half past the hour and will show up on the 45 minutes broadcast. Listening to these scheduled broadcasts would eliminate many weather requests.

The approach and landing phase should begin at least an hour out if you are VFR. After establishing an ETA at destination, a gradual power-on descent may be used. When an unrestricted descent is possible, 200 feet per minute for conventional aircraft, seems quite satisfactory. Thus, at five minutes per thousand feet, determination of the time to commence descent is made easy.

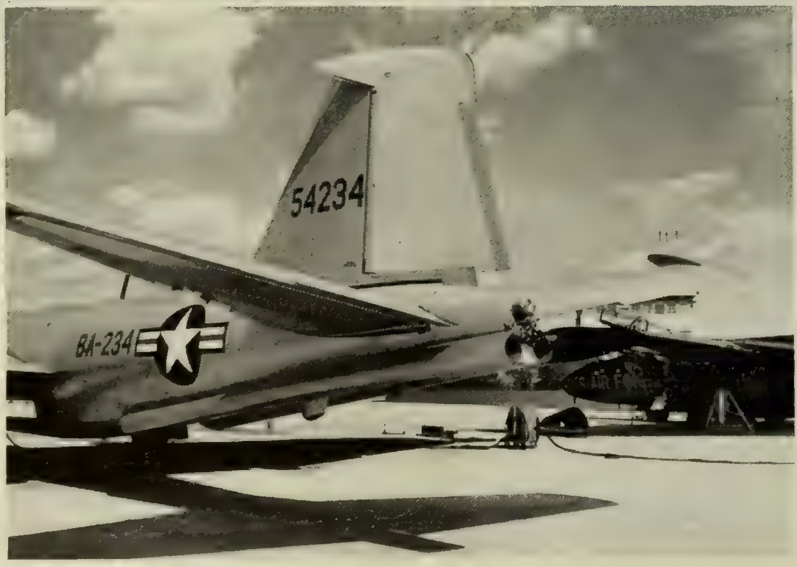
The sharp pilot is thinking about his landing long before reaching his destination. Having listened to the scheduled weather broadcasts, including the destination weather reports, he already knows the wind direction and velocity. Using careful descent planning, he arrives at his destination at pattern altitude.

By referring to the approach and landing charts, he can determine landmarks, hazards and other essential information. Also, the approach chart shows the runways and landing area in detail. When possible, the tower frequency should be guarded as soon as you are within reception range. This way, you should be aware of the landing runway well before arriving. Your planning, with the help of the approach chart, will allow you to enter the proper pattern, line up on final, avoid unlighted obstructions and land safely. At night, especially, if you will keep the runway heading in mind, in relation to the base leg or downwind headings, you should never land on a wide taxiway.

These are only a few tips on flight planning and voice procedures. Why not use them? ●

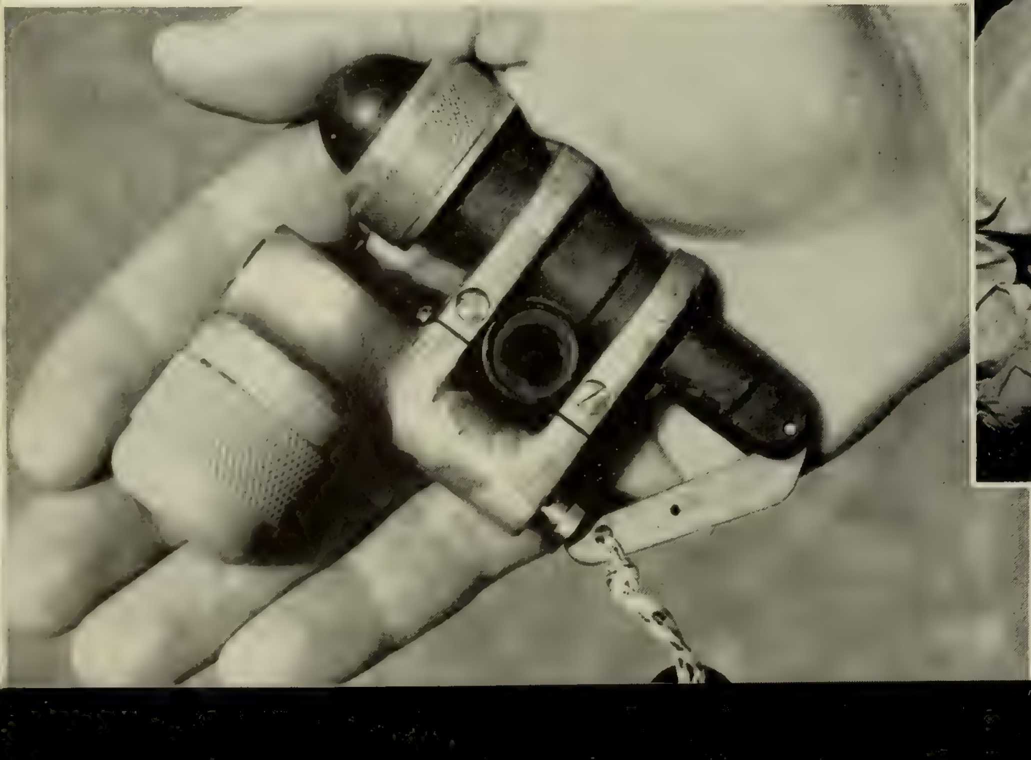
Keep Current

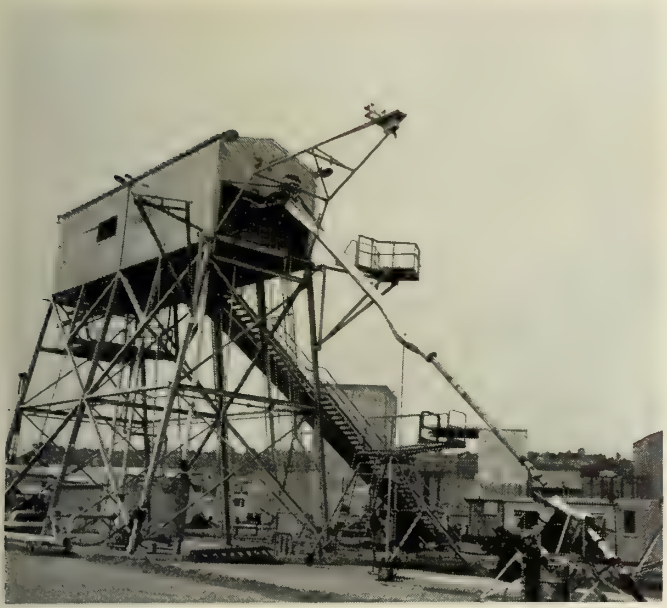
NEWS AND VIEWS



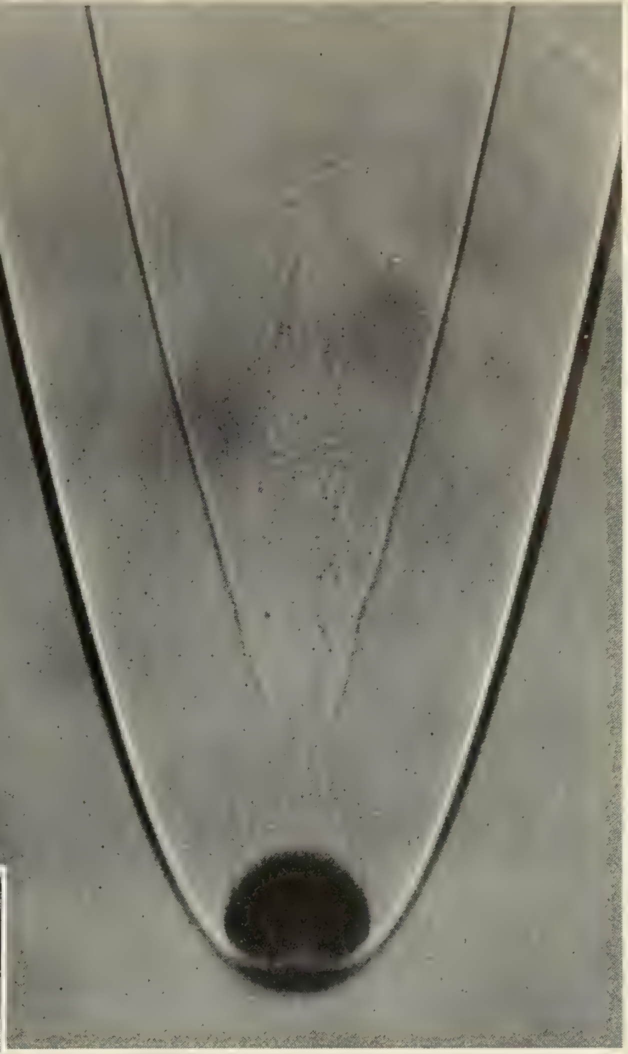
The B-57E is the latest, specially equipped high speed target aircraft. The two long tubes located on the underside of the fuselage release the targets.

Shown below is the new automatic Mae West inflator. Developed by North American Aviation, it will automatically inflate, 15 seconds after water contact.

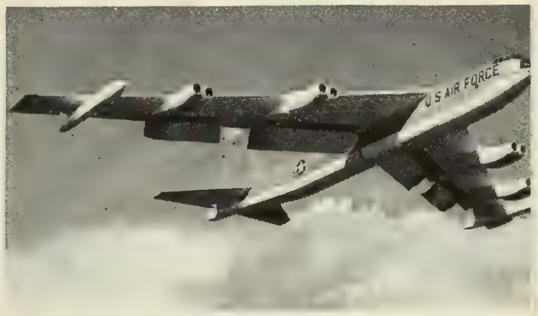




With the coming of the KC-135, Boeing's jet tanker, a new, high-speed refueling boom was needed. Before installation and in-flight tests, the equipment shown here gave engineers data on design deficiencies.



Above, this is what 10,000 mph looks like. The sphere pictured here was shot from a special gun used to get data on temperatures at high speeds.



The B-52 with the larger external fuel tanks also is getting a new, unique bomb bay capsule. Below, the capsule is shown being hoisted into position.

As an Air Force pilot, your health is something you can not neglect. When that annual physical rolls around, you can get an adequate evaluation only if you . . .

Speak!

Colonel Harold V. Ellingson, USAF (MC)
Alaskan Air Command

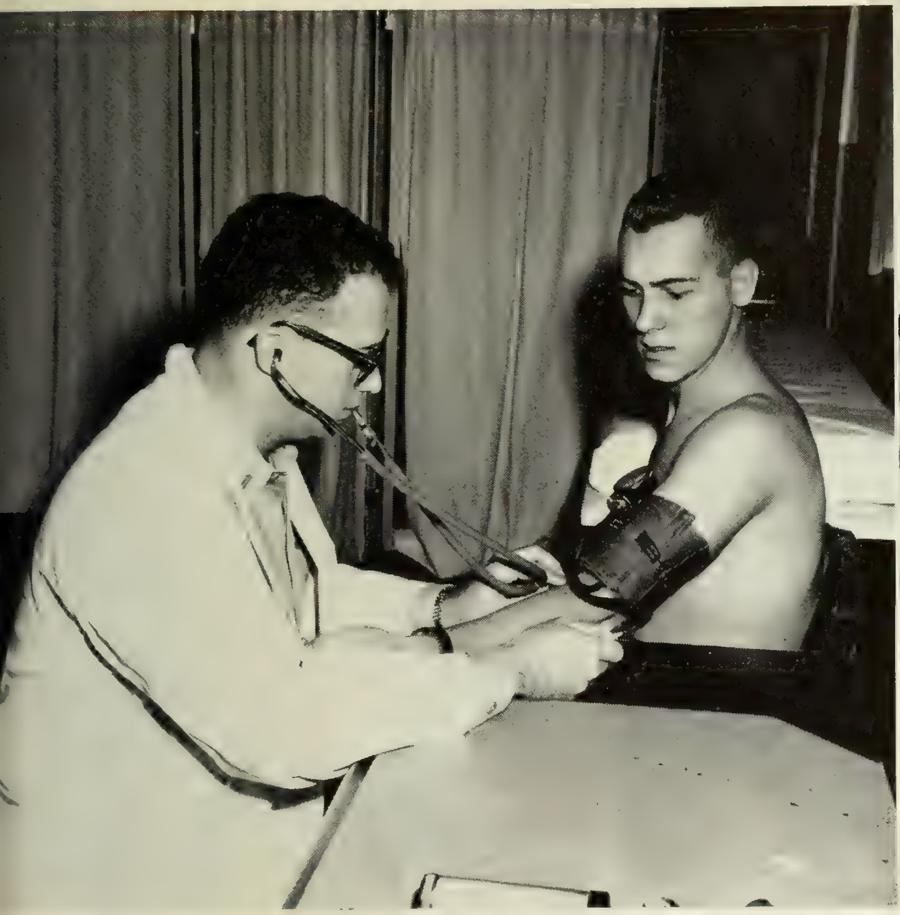
THE ANNUAL physical examination is a very important part of an Air Force program. It's purpose is to maintain peak health. It sometimes falls short of its intended usefulness, however, because of misunderstanding by both medical personnel and examinees. Here is what an annual examination will include, what it can and cannot do, and what you can do to make the examination more profitable.

What It Includes

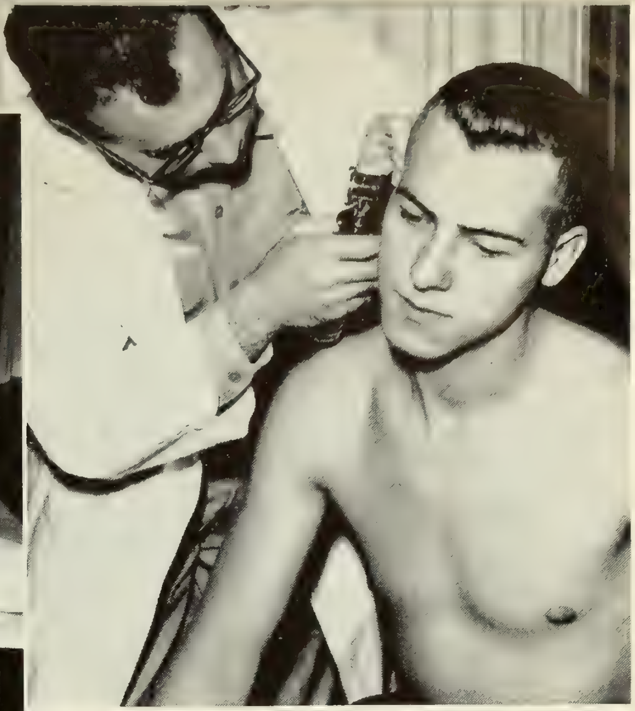
The Air Force Regulation on Annual Medical Evaluations (AFR 160-10) eliminated many unproductive portions of the examination as it used to be given. Listening to the lungs and "thumping" the chest, for instance, almost never yielded information regarding disease, and then only when such diseases were more accurately detected by other means. These and many similar procedures, therefore, were eliminated. Also eliminated were entries regarding height, color vision, color of hair and other characteristics which can be assumed to be essentially unchanged through the years. The effect of these changes was to shorten the examination materially, saving time for both the examinee and the doctor.

The most critical and most informative procedures have been retained, however; furthermore, emphasis is now being placed on the interview with the physician as a means of determining what additional tests or procedures, if any, may be appropriate. The following are the minimum procedures for future annual examinations in this Command for example:

- Dental examination.
- Weight.
- Blood pressure, seated.



High or low blood pressure can be treated so as to prevent some of the important complications.



Even ear ailments can be concealed, so speak.

- Visual acuity, distant, for all personnel; heterophoria for aircrew and air traffic control personnel, and near vision for persons over 40.
- Chest x-ray.
- Urinalysis (sugar and albumin).
- Hemoglobin determination.
- Examination of the rectum and prostate in males over 40 years of age and for others when indicated.
- Electrocardiogram when indicated (required for persons over 40 years of age; that is, beginning with the annual examination immediately preceding the 41st birthday).
- Review by the physician of all findings and medical records of the examinee.
- Interview of the examinee by the physician, with review of symptoms and discussion of personal medical problems. Any additional tests, procedures or consultations suggested by findings or history obtained as above.

It should be realized that the examination procedures, by themselves, will reveal a rather limited number of disorders. Most of these can be enumerated very briefly.

What It Reveals

- Dental decay. As a rule, appointments are made for dental treatments found necessary at the time of the annual examination.
- Gain or loss in weight. Obesity, if found, can be treated for an improvement in general health.
- High or low blood pressure. High blood pressure, if found, can be treated so that some important complications can be prevented.
- Changes in visual acuity. Increasing difficulty in focusing on near objects is normal after age 40; glasses for reading—or bifocals if you've previously used glasses—usually become desirable at some time after age 40.
- Chest x-rays reveal kinds of lung disease, such as tuberculosis and tumors, and enlargement of the heart.
- Urinalysis will reveal some cases of early or mild diabetes, and some kinds of kidney disease.
- Hemoglobin determination will detect anemia, which, in turn, is indicative of either gross dietary deficiency or serious disease which deserves further investigation.
- Rectal examination will reveal many cases of hemorrhoids, as well as enlargement of the prostate (common at ages beyond 60) and some cases of malignancy of the prostate.
- Electrocardiograms are of value mainly in detecting PAST attacks of heart disease.

Detection of other disorders depends very largely on the frankness and honesty of the examinee during the interview. Most disorders can be detected if the physician is alerted by the examinee. Conversely, a large list of diseases can be concealed if the examinee sits mum, thinking, "If the doc can't find it, it can't be very bad" or if the interview is hastily or incorrectly conducted.

What It Does Not Reveal

Without full discussion by the examinee, the annual examination may reveal absolutely *nothing* beyond the items listed above. It is not, except for a few of the disorders listed, of great predictive value ("Guess I'll last for another year").

Even chest x-rays, unless special techniques are ordered on the basis of symptoms reported, may miss some cases of lung diseases. People have been known to drop dead of a heart attack immediately after a normal electrocardiogram. A rectal examination may miss some cases of internal hemorrhoids unless the examinee describes his symptoms. A tremendous variety of digestive disorders may be missed unless symptoms are described. In brief, the great bulk of diseases are detected only by investigation of symptoms.

What You Can Do

The place where your active cooperation is essential is in the interview. Here you should mention any symptoms which might be indicative of serious disease. Here, too, is your chance to ask advice on your personal medical problems.

In these interviews one hesitates to appear a hypochondriac. It has been said that every "normal" individual has a few scattered areas of pain at all times, particularly in joints and muscles. Most of these are below the level of consciousness most of the time. But if a person picks out a pain, and mentally dwells upon it, he can unconsciously raise it to a level where it bothers him a great deal. Obviously it is not desirable to record, classify and recite every ache and pain experienced.

On the other hand, however, most of the indications of really serious diseases are fairly easily recognized. A catalog of all possible symptoms would fill a book. But some of the most important are listed below. Every one of these, at one time or another, has been overlooked, neglected or concealed because someone thought it was unimportant.

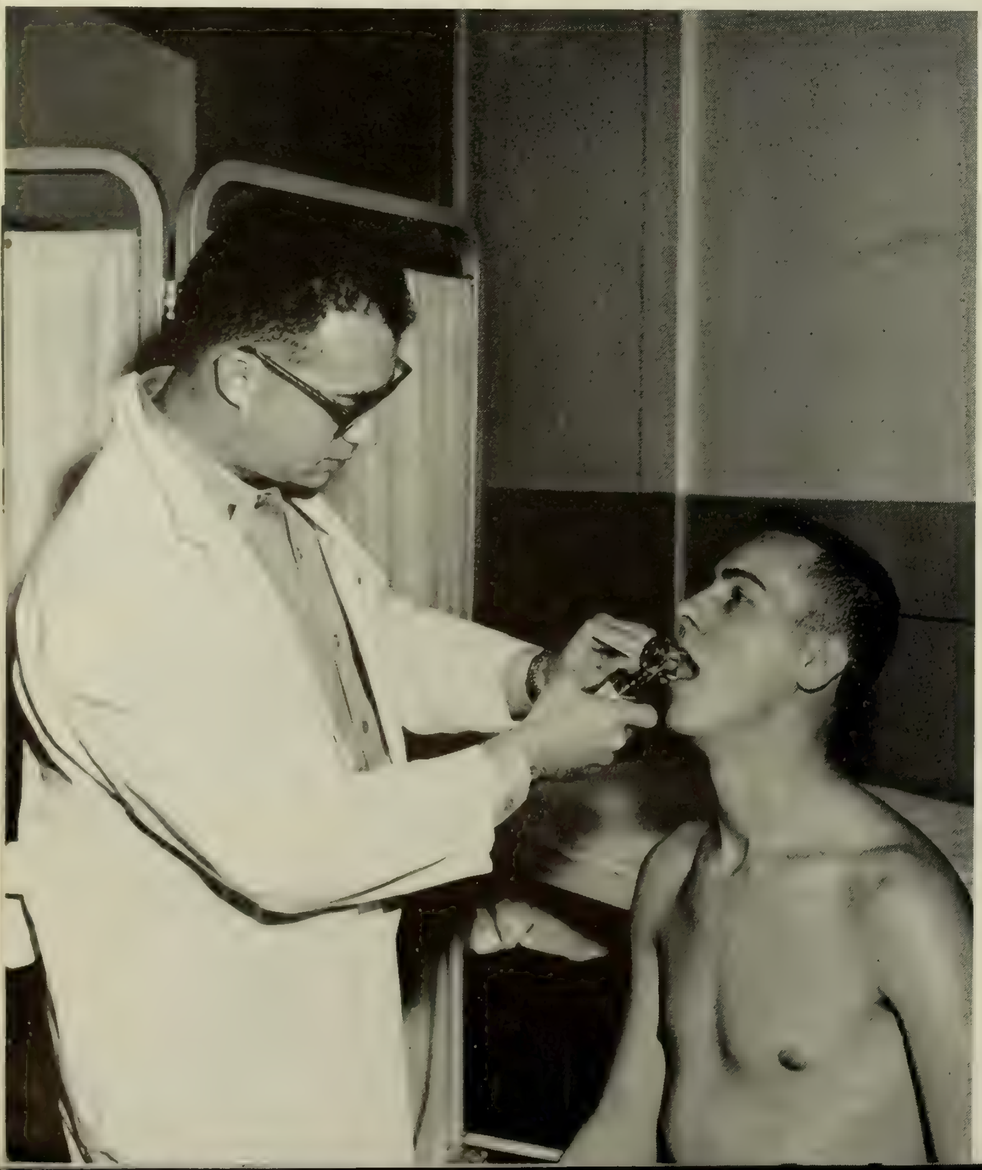
- Any blood discharged from the body in stools, urine or sputum.
- Any dizziness or loss of consciousness.
- Any abrupt or unexplained change in weight. Probably everyone ought to check his weight every few weeks. If you are overweight, now is the time to ask for advice on reducing.
- Any change in bowel habits or abnormality of color or consistency of bowel movements.
- Any change in sleeping habits, as for instance requiring additional pillows.
- Unexplained fatigue or weakness. This does not apply to the desk-bound executive type who goes hunting once a year and finds himself exhausted after walking 50 yards across the tundra. Such a person ought to keep himself in better shape, with regular exercise.
- Any persistent, unexplained headache.
- Persistent cough. Heavy smokers often have a chronic cough, noticeable particularly in the morning. If you're in this category, you smoke too much. A "smoker's cough" sometimes conceals the onset of serious lung disease. If you don't propose to cut down on your smoking, you should at least be alert to any change in the cough, and check your sputum occasionally for blood.
- Pain or difficulty associated with any normal body functions—swallowing, urinating or having a bowel movement.
- Persistent, unexplained "indigestion," or recurrent abdominal pain.
- Chest pain if severe, or if it radiates into either arm.
- Any mass or lump, in any location. Women are currently being coached in the matter of self-examination of the breast. Occasional self-examination of the testes is equally important for men.
- Any sore on the skin or in the mouth which does not heal.
- Any other symptom which has caused you serious concern.

In Summary

The primary responsibility for keeping yourself healthy and for detecting disease in early stages rests with YOU.

You should take the initiative in reporting important symptoms. Any of the symptoms listed above should actually be reported as soon as they are noted. But the "annual physical" will detect *some* of the important diseases. Moreover, it provides an excellent opportunity for you to review your medical status and to secure medical advice on problems of health and hygiene. ●

The Doc can find things by examination, however, he can do better by investigating symptoms.



WELL DONE

Lieutenant

Robert E. Hardin

46th Fl. Sq., Dover AFB, Del.

★

LT. ROBERT E. HARDIN (Radar Observer) and Lt. Frank L. Redditt (Pilot), took off in a T-33 from O'Hare International Airport, Illinois, for Dover Air Force Base, Delaware. They were on the return leg of a navigational cross-country flight.

Cruising at 41,000 feet on a 1000/top IFR clearance, they arrived over the Dover range station after an hour and 45 minutes en route. Weather had lowered below minimums and they were advised to continue to their designated alternate.

Shortly after departing on their new course, the T-33 started a gentle turn to the left. Gradually, the bank increased and the nose dropped. The airspeed increased rapidly. When Lt. Redditt, the pilot, made no attempt to recover from this flying attitude, Lt. Hardin shook the stick vigorously, but there was no response.

Lt. Hardin realized that his pilot was unconscious so he leveled the wings and eased back on the stick. With the airplane under control, the observer started a descent through the clouds and broke out between layers at 30,000 feet. He contacted the nearest Air Force base and declared an emergency. Continuing his descent to 24,000 feet, he saw Lt. Redditt shake his head as he regained consciousness. Fully recovered, Lt. Redditt flew to the alternate and landed.

Examination of the oxygen system the next day revealed a loose connection where the oxygen hose joined the seat quick disconnect.

The quick action displayed by Lt. Hardin and his ability to fly the jet under IFR conditions prevented a possible aircraft accident and loss of life. Well Done!

Runway Check

Major Edward P. McNeff
Fighter Branch, D/FSR

Going down the runway doing 120 per
I'm not sure the bird will fly.
Oh! Raise the barr- - ier - - -
Most of the runway is far behind
The rest is slick and wet.
Mayday, Mayday, Mayday!
Tell me, how do I stop this jet.

THIS IS ANOTHER verse for an old Air Force song which has been sung on fighter bases the world over. The only sad part about it is that the situation described is occurring with increasing frequency. The problem arises because the takeoff distances required for our jet fighters consume most of the available runway before it's time to get airborne or raise the nosewheel. If the situation arises wherein the takeoff cannot be accomplished successfully, there isn't enough runway left to stop.

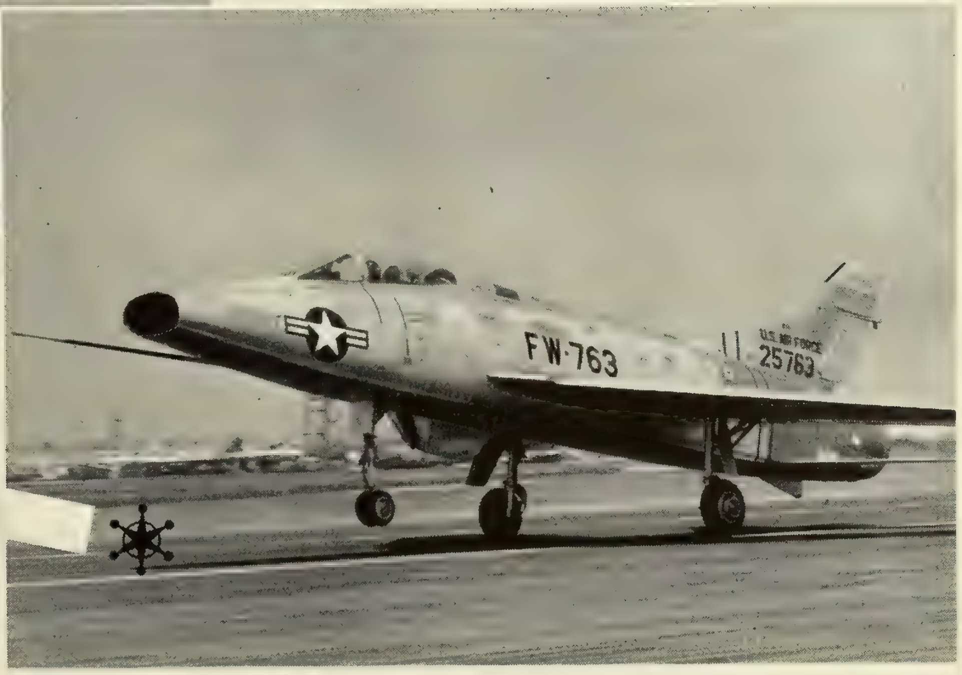
Let's look at the record for 1955. In the past year there have been 76 aborted takeoffs by jet fighters. These aborted takeoffs resulted in the destruction of 28 aircraft (equivalent to one squadron) and substantial damage to 48. The primary reason for the aborts, as stated by the survivors, was that the aircraft did not appear to be accelerating properly and it was not felt that sufficient runway remained to take off.

Nearly all of our runways are marked at 1000-foot intervals (if yours aren't, tell the FSO), and pilots should not be in doubt about distance remaining. Nevertheless, the records indicate that we have a problem in determining acceleration rates accurately and distance available during takeoff roll. Now that we have a problem, what can the JP-4 jockey do about it? The best thing is to check the acceleration rate at some

point down the runway in time to allow ample stopping distance. SAC pilots use such a procedure. The official terminology is "line speed check." The line speed check provides a method for checking speed during the initial part of the takeoff run. It gives

If you are flying a jet aircraft and the strip is hot and high you can buy a little more insurance. It only involves making a "line speed check."

Point



the pilot a good indication of his acceleration in time for him to successfully abort the takeoff if the bird is not performing properly.

Using the graphs provided in the current F-84F Dash One, examples of which are shown here, it is possible to predict two line speeds for a given line or check point on the runway—

- *Normal line speed* which assumes normal takeoff ground roll distance.
- *Minimum line speed* which assumes that the entire runway length will be used for the takeoff ground roll due to low acceleration.

To minimize the number of aborts and assure full utilization of available runway length, the minimum line speed should be used for the acceleration check. If the observed speed at the check point is equal to or more than the minimum line speed, takeoff acceleration is acceptable and the takeoff should be continued. If it is less than the minimum line speed, the takeoff should be aborted. Since the check point is chosen so that the airplane can be stopped on the remaining runway from the normal line speed, it will be less difficult to stop with a speed less than minimum line indicated airspeed.

Now let's take a hypothetical situation and see just how we can use the available charts to insure either a successful takeoff or a timely abort. We will use 4000 feet as our probable safe acceleration check point, along with the following:

- Takeoff gross weight — 22,300 pounds.
- Configuration — clean + (2)-230 gallon inboard tanks.
- Pressure altitude—2000 feet.
- Runway temperature — plus 35°C.
- Length of available runway — 9000 feet.
- Dry, hard-surfaced runway conditions.
- Zero wind.

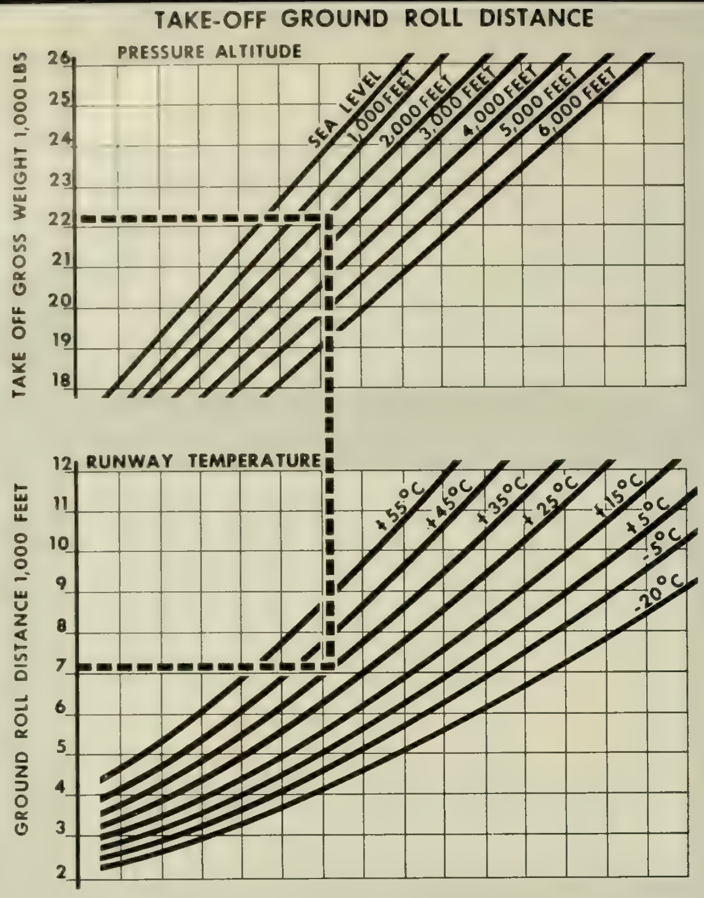
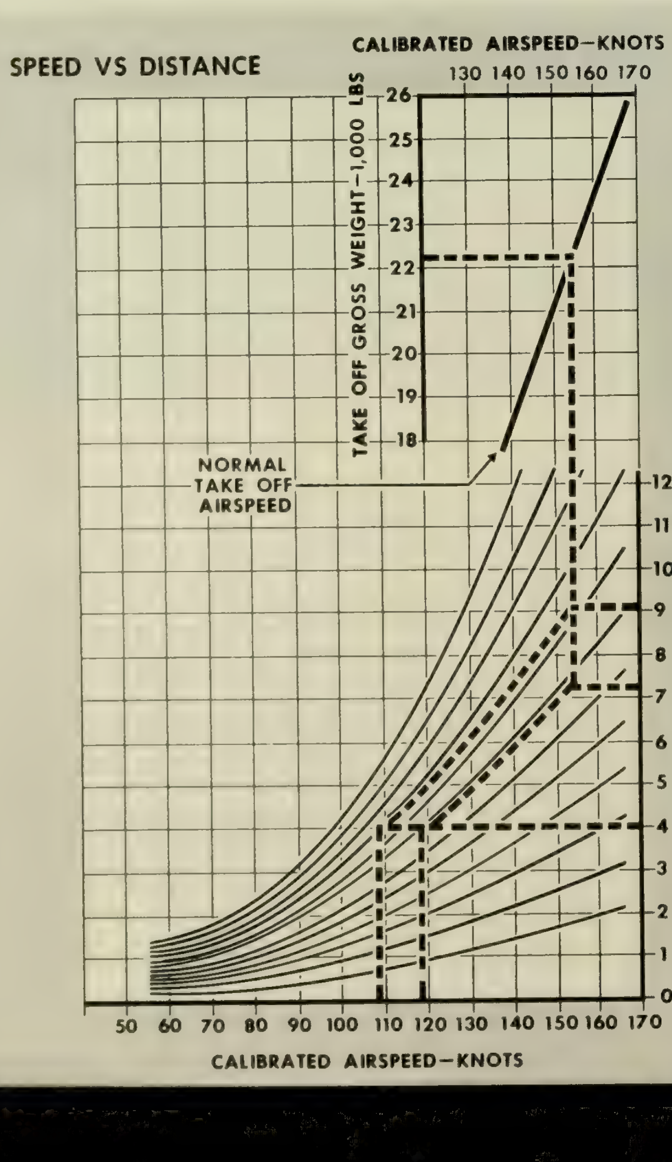


Figure 1

Figure 2



Takeoff Roll

Using Figure 1 at the takeoff gross weight of 22,300 pounds, proceed right to pressure altitude line of 2000 feet. Then trace down to the runway temperature curve of plus 35°C. Ground roll distance of 7250 feet is found at the left.

Normal Line Speed

Referring to Figure 2 at takeoff gross weight of 22,300 pounds, proceed up and find normal takeoff calibrated airspeed of 154.0 knots. Then look down until the guide line intersects the ground roll distance of 7250 feet. Now follow the curve, down to the left, to the 4000-foot distance intersection. The normal line speed of 119 knots CAS is then found at the bottom of the chart.

Minimum Line Speed

To find the minimum line speed, again use Figure 2 at the takeoff gross weight of 22,300 pounds. Read up to find normal takeoff airspeed of 154.0 knots CAS. Then proceed down until guide line intersects the available runway length of 9000 feet. Now look down and to the left, following the guide lines, to again intersect the 4000-foot distance. A minimum line speed of 109 knots CAS is indicated at the bottom of the chart.

Stopping Distance

The stopping distance can be found by referring to the chart illustrated in Figure 3. At a normal line speed of 119 knots CAS, correct for pressure altitude of 2000 feet and outside air temperature of plus 35°C. and intersect the stopping distance curve. Stopping distance required from normal line speed is 2825 feet.

No conservatism or pilot reaction time is provided in Curve A, Figure 3, as pilot reaction time in deciding to abort the takeoff is variable. However, the average pilot will use about three seconds to make a decision, cut power and apply brakes. Therefore, to facilitate ease of planning, Curve B includes a pilot reaction time of three seconds, a total stopping distance of 3450 feet. Thus, on a 9000-foot runway, it is possible to make a check at 4000 feet and still have time to stop, for 4000 + 3450 = 7450 feet.

The specification which establishes requirements for pilot handbooks has

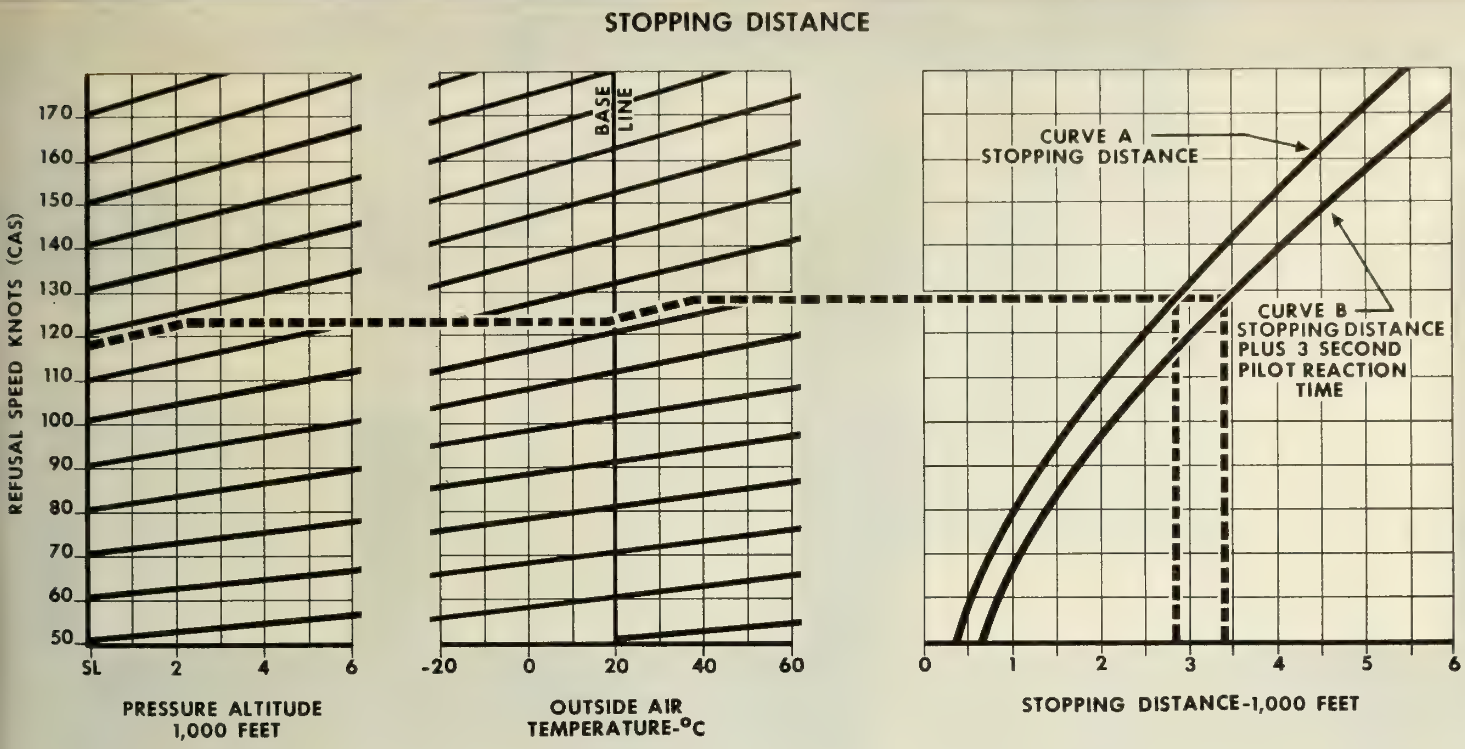


Figure 3

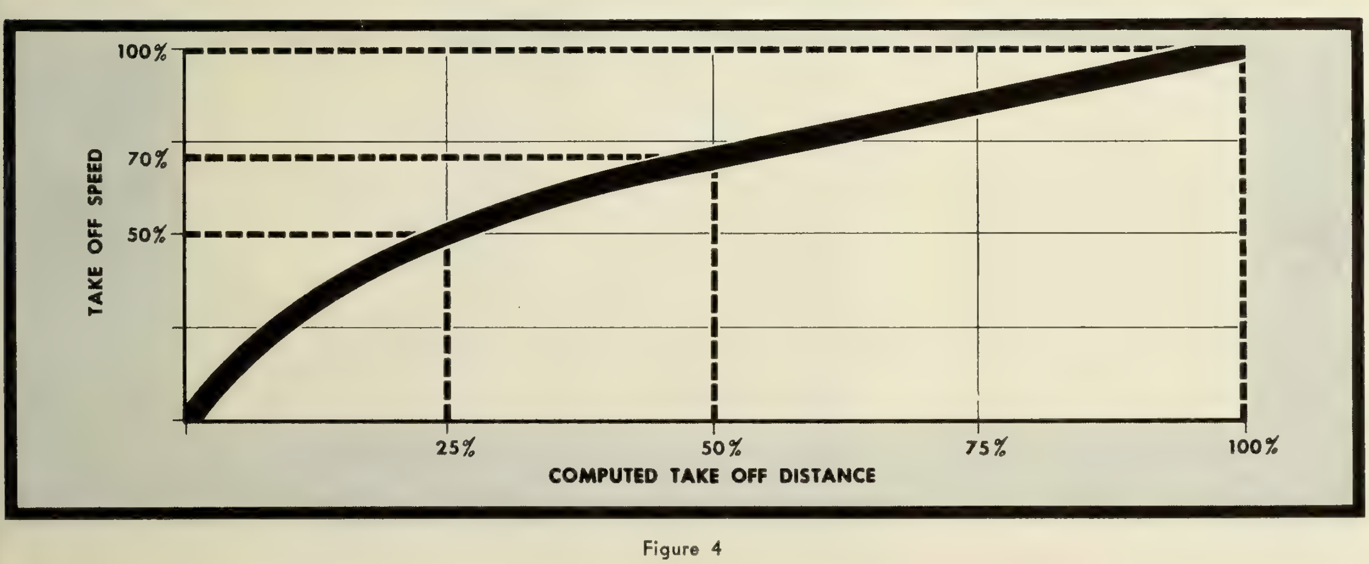


Figure 4

been revised to provide this information in the aircraft performance section. However, if the charts are not available, this simple formula will provide you with a line speed at a desired point on the runway:

$$\frac{V_2}{V_1} = \sqrt{\frac{S_2}{S_1}}$$

V_1 = computed takeoff speed.
V_2 = line speed at desired check point.
S_1 = computed takeoff distance.
S_2 = distance down the runway check is desired (a point should be chosen which will allow sufficient stopping distance).

Let's work one. Consider your takeoff speed as 145 knots; takeoff distance 7000 feet and you want to check your speed at 4000 feet.

$$\frac{V_2}{145} = \sqrt{\frac{4000}{7000}}$$

$$\frac{V_2}{145} = \sqrt{.57}$$

$V_2 = .75 \times 145$
$V_2 = 109$ knots.

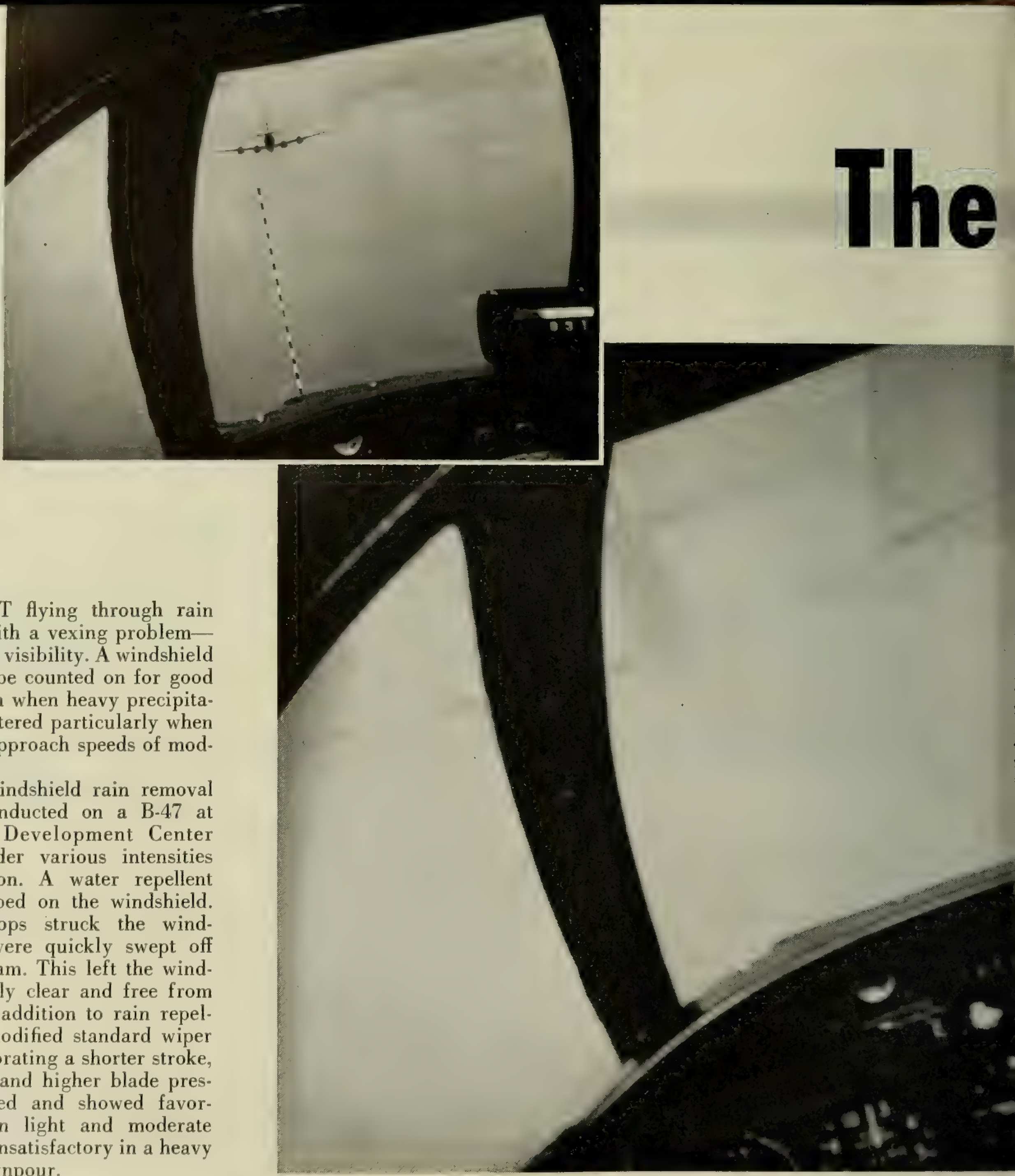
So you should have a minimum of 109 IAS after rolling 4000 feet.

Now, if all of that calculating tends to give you a headache, here's a method that's easy to remember.

At 50 per cent of your computed takeoff distance you should have 70 per cent of your takeoff speed. Note Figure 4, it illustrates the computed takeoff distance.

If the graphs are available in the handbook for your aircraft, use them. However, these other methods will provide a suitable line speed check in sufficient time to allow a successful aborted takeoff. ●

The



Rain repellent has been applied to the right side of the windshields above. Notice how vision is improved during heavy rain. Top photo shows no distortion present during clear weather flying.

ANY PILOT flying through rain is faced with a vexing problem—windshield visibility. A windshield wiper cannot be counted on for good clearing action when heavy precipitation is encountered particularly when flying at the approach speeds of modern jets.

Recently, windshield rain removal tests were conducted on a B-47 at Wright Air Development Center (WADC) under various intensities of precipitation. A water repellent coat was rubbed on the windshield. When raindrops struck the windshield, they were quickly swept off by the airstream. This left the windshield relatively clear and free from distortion. In addition to rain repellent tests, a modified standard wiper system incorporating a shorter stroke, shorter blade and higher blade pressure was tested and showed favorable results in light and moderate rain but was unsatisfactory in a heavy and thick downpour.

Tests

On one flight, a water-filled KC-97 tanker was used to furnish rain conditions of desired intensity established by varying the distance between the tanker and the B-47 test aircraft. Cameras and test instruments were installed to record results during taxi and flight operations. One-half of the B-47 windshield was treated with a selected repellent and the other half remained untreated. In all cases the treated side afforded better visibility in varying degrees depending on taxi, takeoff, approach speeds and rain intensities. While optical distortions such as glare, twinkle and halo were not evident on the repellent windshield area, glare was noted on the untreated side during a night flight in moderate precipitation.

Rain repellent effectiveness during taxi operations depended on the rain intensity, droplet size and aircraft taxi speed. It was determined that airflow of sufficient velocity over the windshield must be maintained since, when taxiing below 30 knots, water droplets had a tendency to adhere to the windshield rather than blow off. During takeoffs in light and moderate rain the treated side was clear but the untreated side had rivulets of water running vertically over the windshield.

Pilots indicated that rain repellents were very good during takeoffs in moderate to heavy precipitation. Visibility restriction seemed to be due to the weather rather than water on

FORWARD LOOK

L. V. Larson, Wright Air Development Center

the windshield. Through the treated side the runway was clearly visible but it was not distinguishable through the untreated side.

Application of the repellent is comparatively simple but the windshield surface must be clean. Bond paste is first applied with a soft clean rag in spots about four inches apart, then rubbed briskly until spread over the entire area. A coat of repellent is then applied over the bond treated area and rubbed briskly with a clean cloth or tissue until the surface is clean. Average application time is five to 20 minutes, depending on the experience of the maintenance personnel.

The effectiveness of a modified wiper system for rain removal proved very good up to moderate precipitation during taxi, takeoff and approach, but in heavy precipitation, with wipers on full speed, the windshield remained flooded.

A combination of rain repellent and modified or standard wiper system was the best for providing visibility under all conditions of rain intensity and aircraft speed.

Another approach to the problem of rain removal is to clear the windshield by means of a hot, high velocity air jet on the exterior surface. The jet blows most of the water away and evaporates the remainder. This method was pioneered by North American on the F-86 and F-100 series and is programmed for several fighters and bombers.

Modification

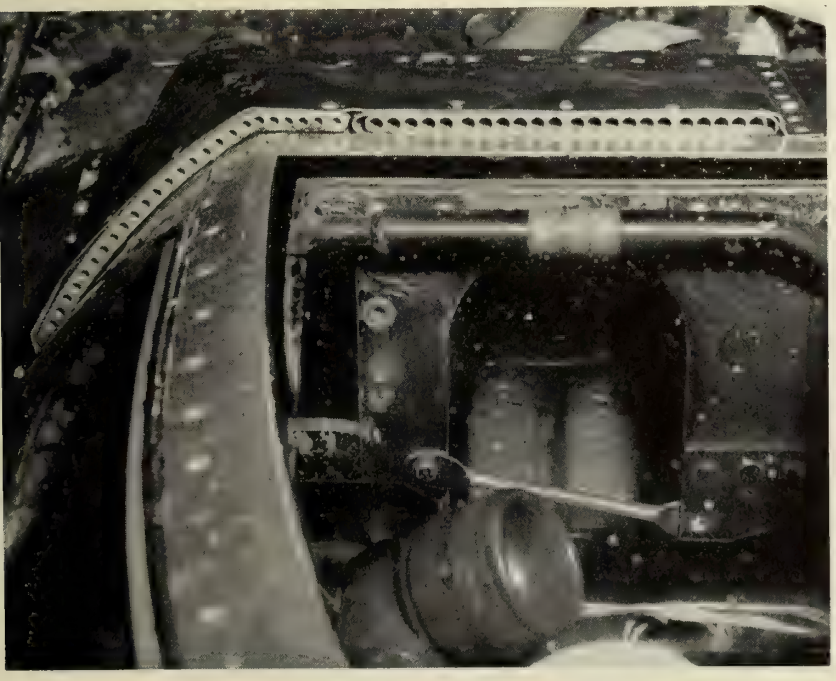
The windshield air jet on the F-86 series was originally intended to provide windshield anti-icing. Use for rain removal was something of an afterthought. Tests of the F-86D at WADC indicated that the system originally installed was effective only in light rain. Therefore, more air was directed into the jet. Fortunately this could be accomplished simply by changing the setting on a pressure limiting valve from 6 psi to 10 and finally to 17 psi. All air was directed to the center panel with none to the side panels. Rain repellent was applied to the side panel. This change also requires addition of a thin layer of non-conducting material over the bottom edge of the windshield to reduce temperature shock and windshield breakage that would otherwise possibly occur.

During level flight and simulated GCA approaches the tests indicated good clearance on both repellent coated and air jet areas. As the rain intensity increased, the repellent coated area flooded first. Shortly thereafter vision was lost on the air jet area. No clearing was obtained on the air jet area during an overhead approach and landing. The engine RPM carried in this type of approach and landing does not supply enough airflow to the nozzles to clear the windshield sufficiently.

Two Jobs

The external air jet does two jobs: Anti-icing and rain clearing. Rain repellents have the obviously desirable feature of almost zero weight. Future research is aimed at obtaining repellents that will withstand temperatures associated with supersonic flight. On new aircraft, pilots can expect to have mixed systems. Rain repellents to give good vision under most rain conditions plus an air jet on a small area for ice protection, extreme rain and those unfortunate cases where someone didn't think it was going to rain and forgot to apply the repellent before takeoff. ●

The windshield air jet on the F-86 was originally intended to provide windshield anti-icing. But, by increasing the air pressure, the installation proved fairly successful in removing heavy rain.



REX SAYS

I READ AN article in the April issue of FLYING SAFETY about a pilot ejecting at low altitude, who lived to tell about it. I'm alive today because of what the pilot emphasized . . . practice, practice and more ejection practice.

Our squadron phased into the latest jet fighters. In my leisure time I parked myself in the cockpit of one of these dudes and went over the ejection procedures. Guess I was like this TV actor who plays the part of Wyatt Earp. It's said that he could draw and fire in a fifth of a second. I can't match that speed, but I got so I could simulate an ejection in seconds without a bumble.

I had flown the new bird for about 20 hours and liked her a lot. Then one morning I had an emergency. Immediately after takeoff, heavy smoke filled the cockpit and I was unable to see. I blew the canopy and observed flames around my left foot. I climbed the aircraft steeply to gain bailout altitude. I ejected while climbing at an estimated 60-degree angle. I must have been at about 2000 feet. My hands automatically went to the right controls. Everything worked smoothly. That's why I'm here.

***REX SAYS**—Congratulations! Nice to have you around. We appreciate hearing how one of our articles contributed to an actual save. You did a right smart job; makes us feel worthwhile to know we had something to do with it.*

★ ★ ★

I GUESS I'm like many other pilots of the younger set. I place too much reliance upon Flight Service and jet metro watch to keep me out of weather trouble.

I know now that Flight Service is not responsible for flight following. Sometimes, because of mechanical breakdowns in the communications system, I have landed at air bases ahead of my flight plan.

I was caught unawares one day when the weather at destination did a 180 from VFR to IFR in about 30 minutes. My alternate did the same quick change. I got down okay but I don't like to discuss it.

My story boils down to one thing. I didn't listen to scheduled weather reports in flight. I didn't ask for any. I gave the required position reports and that's all. I overflew some air bases that had pilot-to-forecaster service available. I could have gotten a landing forecast from them, had I wanted it. Normally, INSAC stations do not give this type of forecast. The old song and dance of getting over a final fix committed to a penetration regardless of the existing weather won't hack it with me anymore. Nowadays, I get a forecast en route.

***REX SAYS**—There have been a few recent accidents where the cause factor was failure to check destination and alternate weather, while en route. Pilot-to-forecaster service also is available at many bases. (See "Lucky 13," FLYING SAFETY, March 1956.) Why not use it?*

★ ★ ★

I KNOW THAT Rex's "IN" basket must overflow at times with stories of flying experiences that have taught pilots important lessons about flying. Well, I'd like to submit mine for what it's worth.

I had only 11 hours in the F-84 type aircraft before my episode and had not flown in one for the past 80 day period.

I made the customary inspections

REX SPECIALS

A CONSIDERABLE number of unsatisfactory reports have been received on the MA-1 and MA-1A landing arrester barrier. Both URs and engagement reports indicate no materiel failures but simple failure of the system to engage the aircraft. With proper installation, maintenance and inspection, the barrier should be 95 per cent effective.

It appears that the difficulty stems from lack of compliance with the T.O., use of non-standard equipment and lack of assignment of responsibility.

Base FSOs should take a double check to see that the barrier is properly installed, maintained and inspected. Wright Air Development Center should be contacted prior to any locally devised modification.

Patience Gridley, when the weight of the paper work equals the weight of the aircraft, we'll be cleared to go!

and checks and received clearance to taxi out for takeoff.

Approximately two minutes after takeoff, the engine vibrated violently and there was an explosion in the aft end. I declared an emergency and headed for home.

Now, my ineptness appeared. Not having flown this model in well over two months, the cockpit suddenly looked like a watchmaker's shop. Everything seemed to be fluctuating. I guess I hit a few wrong switches and did some other obvious things out of sequence.

I found myself on the final with a high landing airspeed and holding an unaccustomed amount of back pressure. Why? Well, in all of my haste to get back on the ground plus the unfamiliarity with the cockpit, I had failed to retrim after extending the landing gear and wing flaps.

My final approach was erratic. I had an excessive glide angle and I made contact with the runway in sort of a sideslip. Why the gear didn't fold is beyond me.

The only reason I tell this is to bring out the following point. I thought that I was current in this type aircraft. I might have been current on paper but I certainly wasn't proficient or current when something went wrong. I believe the directives now, when they say that a pilot must complete frequent flights in order to maintain proficiency.

REX SAYS*—I only wish more pilots would believe the same thing. The accident rate would really take a nosedive.*

★ ★ ★

IN ONE OF OUR daily squadron Flying Safety meetings, the FSO nailed some of us IPs about simulated emergency flight procedures. I didn't give his statement much thought right then, but what happened two days later brought his warning vividly to mind.

My job was to check out in the B-26 all newly assigned second lieutenants. I have always tried to be as realistic as possible about emergencies, especially during single engine operation.

During this particular check, I had a lieutenant making an ADF approach to the field. We were letting down to minimum altitude when I cut an engine on him. He went through the procedure right rapid like, but as he was doing it, he was inadvertently pulling back on the control column. I thought I'd let him go a little farther before I took over. Then for some unknown reason, he horsed back on the column and we were in trouble. The B-26 shuddered before I could push forward. By the time I got the faltering bird level, we were skimming the tree tops and I had little trickles of sweat running down my cheeks.

I know that I did two things wrong. First, I permitted practicing simulated single procedures at low airspeed and low altitude; second, I let confidence in my flying ability override my judgment when I chopped that engine. All I can say is, "Brother, never again!"

REX SAYS*—Recent accidents have occurred which reflect these same types of faulty practices. Don't let a simulated emergency turn into the real thing.*

★ ★ ★

I'M SENDING this hazard report to Rex for what it's worth. I was the pilot involved.

It was a warm spring day with winds gusting from 35 to 45 knots. I had just completed my flight and was crawling out of the cockpit of my F-86. As I stepped on to the wing, I was not aware that the key attached to the automatic chute arming lanyard had hung up in the canopy rail. The lanyard was pulled and the automatic release activated. As my back type chute popped, I grabbed on to the canopy, but the wind was too strong and I was yanked off.

Fortunately, I had on my B-15 jacket, my gloves and hard hat. My head struck the open speed brake door, then the ground. I rolled over on my side and had a rough 300-foot ride before my chute tangled with a ground object and I was able to collapse the canopy.

I was extremely lucky. I was only skinned and bruised. What can pilots do to prevent this sort of thing from happening in the future? Here are my personal ideas:

- Make sure the crewmembers are aware of this hazard.
- Install a small pocket on the harness to hold the key and strap.
- Have crewmembers attach the strap and key to the lanyard just prior to flight and remove it before leaving the seat.

REX SAYS*—That was quite a ride! Your recommendations make sense. I, for one, plan to make sure that key is safely out of the way when I leave the cockpit.*

No Strange Fields

The book containing the low approach and landing charts has more names than a Spanish nobleman. It is called The Pilot's Handbook, PHACUS and Letdown Book, just to name a few. Regardless of what you name it, it fits neatly into your own preflight picture.

HE HAD HIT his ETA right on the nose. Another hour and he would ask for permission to start his penetration.

He pulled the low approach and landing chart handbook out of his coverall pocket and flipped it open to the proper page. His experienced eyes focused systematically on every detail. He forced open the circular rings and removed the page from the book. He placed it under the hold-down snap on his left thigh.

Silently, he mused, "According to that last weather report I should break out about 800 feet. With the vis holding at one mile, there should be no sweat."

One hour and ten minutes later he was walking into base operations.

What is all of this leading up to? By this time in an article, the pilot has either made a flagrant mistake, declared an emergency or has encountered severe weather elements and is just about out of fuel. What gives here?

Simply that most of the successful flights made by pilots these days are the products of proper preflight planning. This includes referring to the appropriate instrument low approach and landing chart . . . before takeoff, as well as just prior to starting your letdown.

How does this book fit into the preflight picture? Join me as I look over the shoulder of our imaginary pilot. He is studying the landing side of one of the charts.

"Hmmm, parallel runways. 32R is 8000 feet long and 200 feet wide. Any obstructions? Oh, oh, a couple of 350-foot smoke stacks just to the right of the approach to 32R. Also a 500-foot tower off to the left." He mused.

"It is always a good idea to know as much as possible about the airfield layout and adjacent area. In case your letdown isn't just right and you drift too low or off to one side, it's nice to know where the obstructions are located. Tangling with one of those smoke stacks or TV towers isn't exactly conducive to longevity."

He saw me leaning forward.

"Also, when I break out I like to know what to expect. How many times have you suddenly become contact and found yourself staring at a confusingly unfamiliar maze of runways and taxiways?"

I didn't answer.

He turned back to his work and his finger underlined the heading and distance to the field from the radio aid. Next, he looked at the lighting data, availability of a rotating beacon, obstruction lights and type of approach lights.

He looked up and said, "Checking this side of the chart during preflight need not be a lengthy process. What I am after is a general idea of what to expect. Some airfields have odd layouts, high obstructions, no taxiways, lights and so on. It's just plain good sense to check before leaping off."

He then flipped the sheet over to the "low approach" side of the chart. He quickly noted the type of radio facility, initial penetration altitude and type of penetration or procedure turn. Next, his gaze concentrated on the most important part of all.

"The landing minimums are 500 and one. Shouldn't be too bad, and the missed approach procedure is to turn to a heading of 150 degrees and climb to 7500 feet."

"It is important to remember the initial missed approach heading. While cleaning up the bird for a go-around you certainly don't want to have your head in the letdown book trying to find the missed approach heading."

Satisfied, he walked over to the dispatch counter, his preflight completed. He was stuffing the 175 carbon in his pocket as I stopped him short of the door.

"Is that all there is to using the Pilot's Handbook?" I asked.

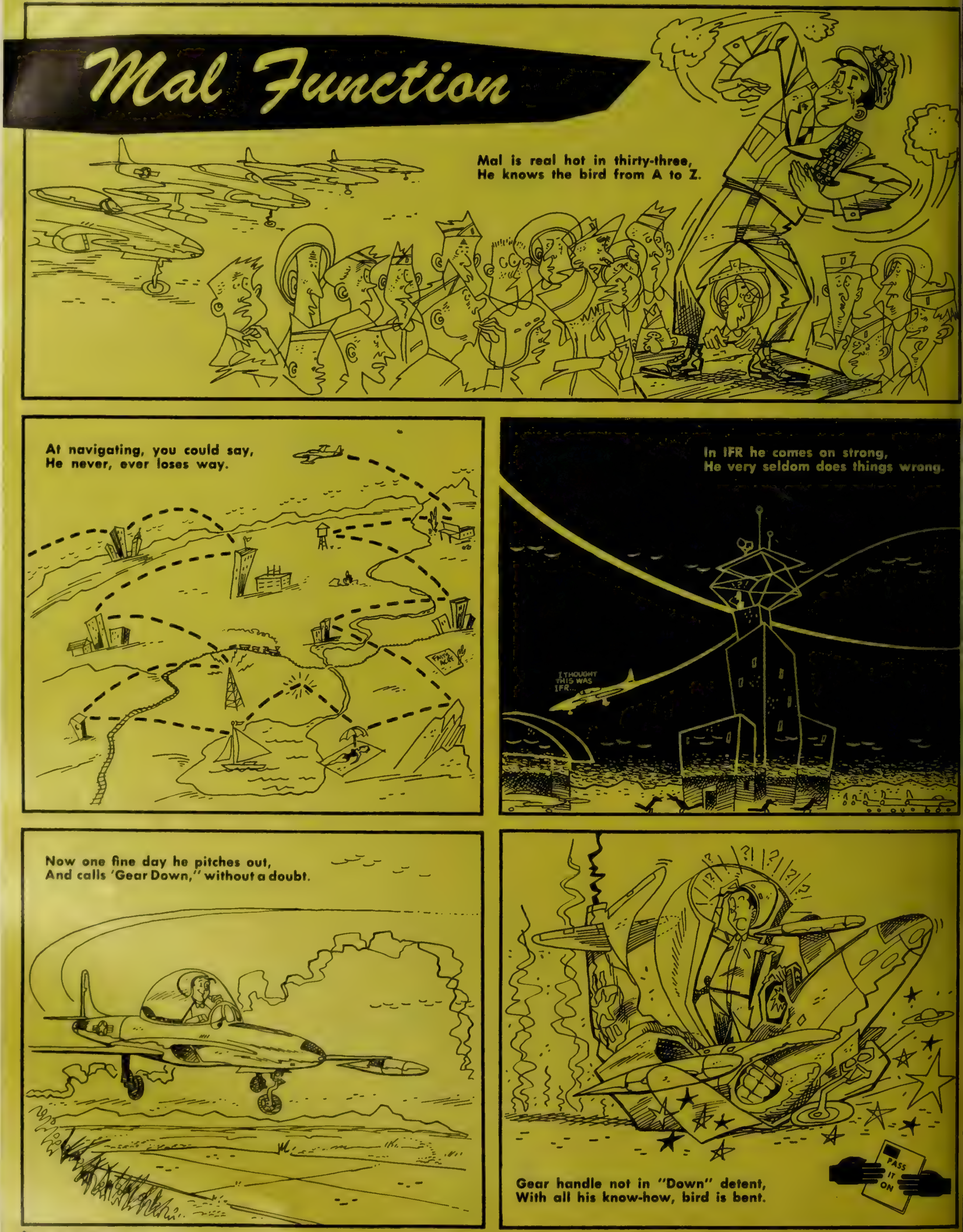
"During preflight, yes. But I'll pull the chart out before my ETA and go over it again and have it ready for reference. Then, when I make my letdown I know what to expect. I've got the whole picture."

Every day there are flights made by pilots into strange fields. The sharp pilots don't wait until they receive letdown instructions before looking over the chart. They know what to expect before, during and after the letdown. And when they break out they know how the physical layout of the field will appear. To them, there are no strange fields. ●

REAL COOL . . . .

It's okay for this little gal
to sport light, skimpy apparel. She
isn't about to leap off to 40,000 feet.
Up there, it's real cool !
Don't let the heat on the deck
dazzle you into leaving half of your
flying equipment in the ready room.
The many reasons for wearing proper clothing
will easily off-set those few minutes of
heat discomfort on the ground.

Mal Function


Mal is real hot in thirty-three,
He knows the bird from A to Z.
At navigating, you could say,
He never, ever loses way.
In IFR he comes on strong,
He very seldom does things wrong.
I THOUGHT THIS WAS IFR...
Now one fine day he pitches out,
And calls 'Gear Down," without a doubt.
Gear handle not in "Down" detent,
With all his know-how, bird is bent.
PASS IT ON

°U. S. GOVERNMENT PRINTING OFFICE . . . 362337

629.1305
FLYS

SEPTEMBER 1956

FLYING SAFETY

UNITED STATES AIR FORCE

THE LIBRARY OF THE
OCT 1 1956
UNIVERSITY OF ILLINOIS

Winter, Just Around the Corner . . . page 4

FLYING SAFETY

VOL. TWELVE NO. NINE

File Thirteen

As depicted by our cover, winter is upon us. It may not arrive at your base for a bit, but best dig out those ear muffs and be ready . . . . . . A reminder if you drive a jet. On an IFR flight plan, direct or on airways, you must report at least every 200 miles. The reporting points selected must be entered on the 175. This also goes for recips that are IFR, direct, off airways . . . . . . The ACIC folks tell me that the Standard and Jet Pilots Handbooks will soon carry a notice that "circling ceiling provides the required clearance of 300 feet within 1.7 nautical miles only from the approach end of all runways." Seems there have been a rash of violations filed against pilots for using the circling minimum outside of the 1.7 mile zone. . . . Major John R. Phillips from Eglin, probably holds the record for the lowest, successful ejection. He recently went out of an F-89 at about 300 feet. Space prohibits a blow-by-blow account, but he had full automatic equipment, did things in the right sequence and came out with only a sore shoulder and back. . . . Next month we'll have something on the F-102 winter tests and a story on flying the KC-135. It's quite a bird. . . . See you then.

Perry J. Dahl

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major V. R. Stutts

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby
T/Sgt. Chester McCubbin
T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune
A/2C Al Fagerwick
T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

Crossfeed 2

Winter Weather Hazards 4

Ice . . . in the Mill 7

On the Surface 9

Oops . . . Wrong Switch 14

Well Done 19

Knee High to a T-37 20

Look Sharp 25

Word For Your Bride 26

★ ★ ★

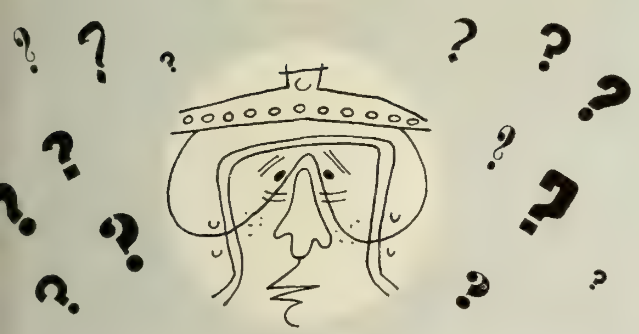
SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $4.25 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

How Well Can You Remember?

If you miss more than four you had better check those back issues.



July

1. The normal search period for airmen downed over the water is approximately:
   a. 2 days.
   b. 6 days.
   c. 10 days.
   d. 14 days.
2. Above...............feet, the only adequate defense against low atmospheric pressure and abrupt decompression is partial pressurization of the body.
   a. 35,000.
   b. 45,000.
   c. 50,000.
   d. 60,000
3. What is the record for the longest survival at sea (on a flexible life raft)?
   a. 17 days.
   b. 21 days.
   c. 33 days.
   d. 47 days.
4. What action should you take if you find an error in a Radio Facility Chart—or better yet, want to suggest an improvement?
   a. Submit a UR.
   b. Write a Disposition Form to your Commander.
   c. Fill in the prepared post card.
   d. Notify Flight Service.
5. What is the primary cause of the turbulence created behind an aircraft?
   a. Wake.
   b. Rotation of prop or turbine.
   c. Wing trailing vortices.
   d. Vortex generators.

August

6. The B-66 is equipped with what engines?
   a. J-47.
   b. J-65.
   c. J-71.
   d. J-79.
7. The most recent weather report broadcast takes place:
   a. 15 minutes after the hour.
   b. 45 minutes after the hour.
8. You can assume that if there is anything wrong with you, the Flight Surgeon is going to find it during the examination phase of your annual physical.
   a. True.
   b. False.
9. The main reason for calculating a "Line Speed" is to determine:
   a. If engine is performing properly.
   b. Acceleration rates and runway distances.
   c. Engine thrust available.
   d. Distance required for takeoff roll.
10. What is the average length of time it takes a pilot to decide whether to abort a takeoff and then react?
   a. One second.
   b. Three seconds.
   c. Five seconds.
   d. Seven seconds.

September

11. You are flying your jet in icing conditions. It has retractable inlet screens, so you should be certain they are:
   a. Extended.
   b. Retracted.
   c. Left set where they are.
12. Inlet duct icing can occur without the formation of ice on the external surfaces of the aircraft.
   a. True.
   b. False.
13. A technique known as "throttle burst" is used on some aircraft to:
   a. Maintain cockpit temperature at a given level.
   b. Keep fuel lines from freezing.
   c. Prevent icing in air inlet.
   d. Facilitate an emergency go-around.
14. Control surface buffeting caused by ice accumulation cannot be distinguished from buffeting caused by approach to a stall.
   a. True.
   b. False.
15. The thrust attenuators on the T-37A . . .
   a. Reverse thrust for landing.
   b. Cut down thrust on final approach.
   c. Restrict airflow to the engines.

ANSWERS

1.	b	6.	c	11.	b
2.	b	7.	b	12.	a
3.	d	8.	b	13.	c
4.	c	9.	a	14.	b
5.	c	10.	b	15.	b

LETTERS TO THE EDITOR

Record Time

Have you any record of the maximum number of hours flown by a B-25 type aircraft during a 30-day period? We are interested in bettering any record set by any other Air Force unit.

M/Sgt Vincent P. McGann
1403d Flt Line Maint Sq
Andrews AFB, Maryland

That's a nice record to shoot at, but let's not forget, the best one is maximum "accident free" time. We have no info on max. hours flown.

★ ★ ★

Food For Thought

I would like to take issue with you on your standardization article, "You . . . From the Same Mold," in your June issue. Stand boards are great stuff, as such, when they stick strictly to business, which is making sure that people follow the Dash One and supplements thereto, but invariably they cannot do this and start branching out. They tend to grow, like Topsy. They then tend to go to the point of dictating what you will say on the interphone, where your hands will be placed on takeoff (besides covering your eyes, if you're a CP). I have yet to see a stand board that did not do this. They also start publishing little *billets-doux* called SOPs, which normally don't quite agree with what AMC or someone else has already published and then the arguments start. When you start arguing, you've shot a large hole in your board and you may as well cancel the whole thing.

It is impossible to standardize a batch of pilots to the degree which some of your articles call for because we are not all stamped from the same mold. (How dull it would be, if we were!) It is possible to make sure everyone is doing as per the "company handbook" which is all the airlines ever demand or desire of—to drag in that overworked phrase, the "professional pilot." Basically, I think this is all you are after, but quite a few of the boards I've been on and under, go off the deep end on this stuff and some of your articles just stimulate this tendency.

Well, I've had my mumble; hope no feelings are hurt.

Capt. R. R. Lawrence
6000 Ops Sq, APO 704

I figure this will stir up some kind of a hornets nest. But you certainly have a point. You can overdo anything. And thanks for your mumble!

★ ★ ★

Commander at Work

This Headquarters reviewed with extreme interest the article, "You . . . From the Same Mold," prepared by Lt. Colonel Mitchell J. Mulholland, and published in the June 1956 issue of FLYING SAFETY.

The message which Colonel Mulholland's article contained and the effective manner in which it was presented made widespread dissemination throughout this group mandatory. To insure that each pilot availed himself of Colonel Mulholland's thoughts on standardization, an individual letter was dispatched, together with an extracted copy of the article in question . . .

. . . This Headquarters wishes to express its sincere appreciation to the Director of Flight Safety Research and to Lt. Colonel Mulholland for the capable and professional presentation, "You . . . From the Same Mold." We are convinced that articles of this nature will do much to strengthen all echelons of the United States Air Force. The ultimate benefit in operational equipment and lives saved is incalculable.

Col. Marshall H. Strickler, USAF
Commander, 9th Air Rescue Group

Words such as these makes our efforts in the flying safety business seem more worthwhile.

★ ★ ★

Dim, Dim the Lights

Having been a reader of FLYING SAFETY for many moons, I have picked up some of the most helpful hints that no T.O. has ever included! Don't misunderstand this statement, but a T.O. can't give technique. Anyway, Crossfeed is a real source of information and helpful hints so here is a note perhaps worthy and perhaps not. Action may have been taken by now but I haven't seen any results at our strip.

It was a field grade night and yours truly had the hop from Webb AFB down to El Paso on a navigational weekend flight. While breezing along in the old T-Bird newer model with the individual lighting on the gages, I noticed two sets of instruments, the regular ones on the panel and the addition of a faintly glowing red set which covered about half of the windscreen by virtue of reflection. This wasn't too disturbing until I found that my eyeballs had become accustomed to the red glow on the screen and when an airliner was overtaken I suddenly discovered that the red flasher light on the tail of the big bird was not part of the reflection on the screen.

Although it wasn't close this time, it might well have been and it could happen on one of those "clear as a bell" VFR nights when the driver gets a little "too accustomed" to too many red lights. So . . . why not modify the new T-33s and put a three or four-inch hood above the panel like those on the F-86s and other birds? Wouldn't cost too much and might just help some guy who is getting a little beat from a long, long flight.

Just a suggestion for anyone who might be interested and not a device to dispute the most sensible words, "Keep the head on a swivel and always look around."

Again, I say there is no other magazine that I know of which will give the airplane drivers more useful information than yours does. If possible, I'd like to get a personal subscription if there is such a thing.

1st Lt Robert L. King
Hq 3645th Plt Tng Wg
Laughlin AFB, Texas

Thanks, Lieutenant, for the generous words about FLYING SAFETY.

As for the hood, it is available for the '33, although it isn't normally installed. It does eliminate glare on the canopy for night operation but because it partially obscures some instrumentation, a lot of T-bird drivers don't want it installed.

Perhaps you may be flying with the lights turned up too high. Suggest you try turning them down and see if you can strike a happy medium that will provide instrument reading as well as forward visibility.

For a year's subscription to Flying Safety Magazine, just send $2.50 to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

★ ★ ★

Plain, Old Socks

Read with interest your article on wind shear. Here's my suggestion: Just plain old, humble wind socks (erected and maintained serviceable).

Educate pilots to take at least one glance at them, to help break up that fixed stare at the gages and so-called magic area.

T/Sgt H. Davis
3513th CCTS
Randolph AFB, Texas

Tall oaks from little acorns grow. Actually, the wind shear problem is a little more complex than merely knowing the surface wind direction. To be effective, the wind sock would have to be rigged on a pole some 300 feet in the air, with three or four socks located up and down the pole.

Thanks for writing, Sarge. Often it is a simple idea like this that solves some of the most complex problems.

★ ★ ★

The Penlight

I have read Colonel Ross' article in the May issue about a pilot losing his flashlight. He suggests that the pilot tie a string around the flashlight and hang it around his neck. Why doesn't the Air Force procure the Flashlight: penlight w/lanyard (Navy BuAer R-17-F-13475). It's a must for all Marine pilots.

T/Sgt Roy E. Bonnot, USMC
H&HSq (StaOpns Mat.) MCAS
Kaneohe Bay, Oahu, T. H.

The Air Force considers the penlight unsatisfactory for its varied operations. Among other objections, it is not of sufficient intensity for seeing ice formation on the wings, aileron trim position and such. FLYING SAFETY *certainly is not criticizing the Marines' equipment. We're sure it has proved satisfactory for your particular needs.*

★ ★ ★

Look Right

Although I enjoy your magazine a great deal, I haven't the training to offer much constructive criticism on its articles.

I did, however, note a slight error in the July issue. In the "Rex Says" section there is a letter defining prevailing visibility. It presents a situation in which the visibility is two, three, four and five miles in the four quadrants and goes on to say that in such a case three miles would be reported. This is incorrect, as prevailing visibility is that distance which can be seen throughout half *or* more of the horizon. Therefore, in this case your answer would be four miles. Just a detail, but as Rex says, "It's the finer points . . ."

As I said before, I enjoy reading FLYING SAFETY and feel that it's an outstanding publication.

Anthony Skey, A/2C USAF
20th Weather Sq

You are correct. The originator of the letter to Rex was in error. The Manual of Surface Observations states, "Prevailing visibility is the greatest visibility which is attained or surpassed throughout half of the horizon circle, not necessarily continuous."

Thanks for setting us straight and for your nice comments regarding the magazine.

★ ★ ★

Better Paint Job

While reading the article, "Bouncing Thru the Boondocks" in the March issue, pertaining to accidents resulting from undershooting runways, I pondered the cited proposed solutions.

I understand the undesirable aspects of painting a touchdown point to serve as a landing target, but please consider this: Paint the 200 to 500 feet of runway at the approach end to blend with the terrain (brown, adjacent to dirt, and green to grass, and so on) until we get to snow. Now, there's a small detail I haven't worked out but then I'm pretty far south.

But, seriously, it seems we need an approach area which is physically a part of the runway, same composition, with no lip or shoulder, and one that psychologically is not considered a part of the runway.

A good job of camouflage may be the answer to preventing some of these accidents.

R. D. Smith
Quality Analysis Div
Brookley AFB, Alabama

Not a bad idea. When you get the snow problem solved, let us hear from you. Some commanders have already moved the runway thresholds in some 500 to 750 feet, where runway length has permitted.

WINTER WEATHER HAZARDS

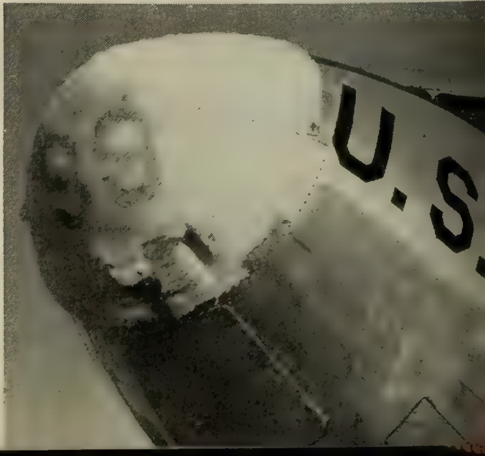
Major U. H. Nenon
Air Weather Service

It may come as a surprise, but winter is just around the corner. From now on through the winter months, FLYING SAFETY will carry a special winter section in each issue. Stay ahead of the game by starting to think about winter weather flying now, for it won't be long.

NEVER UNDERESTIMATE the power of a woman. The woman in this case is Mother Nature. The old gal really has a nasty disposition in the winter season, but like many another man who contracted for better or worse, you can learn to live with her. Accident rates prove this; they are not much worse in December through February than in other months. You just have to be considerate, that's all. Don't fight it; it's bigger than both of us.

Of course, things can get awfully difficult. When the airline operators see the figures on IFR weather in January, they shudder like a husband confronted with a full-page ad for mink coats. It all hurts that old bank balance in the end.

Figure 1 shows, in generalized fashion, the incidence of really stinking weather of the United States (ceilings less than 500 feet and/or visibility less than one mile). With the exception of some local areas notorious for persistent ground fog, these poor flying conditions are mostly associated with frequent storms and a com-



Structural icing is just one winter hazard.

bination of troubles. For most of the country, it is obvious that things aren't extremely tough very often. Just remember on a low approach, one miss can make a miserable mess.

Surface Winds

Since surface wind is by far the most common weather factor involved in accidents, don't think you're safe just because the wheels are touched down. Although that gusty blow-hard, the thunderstorm, has gone south for the winter, there is still plenty of turbulence in the strong, rough winds that zip across the northern states in winter with the cold air outbreaks. There is a marked preference of notably strong surface winds for the region north of the seasonal mean 180 days-of-frost line. Great Falls, for instance, has surface wind 25 mph or more, 11 per cent of the time in January. When the demand for careful landing and ground handling technique is complicated by snow and ice on the runway, a precarious situation results. The extent of this region requiring special care is indicated in

If your bird has propellers, watch for ice.

If you plan your flight carefully and know something about icing, you can avoid this.

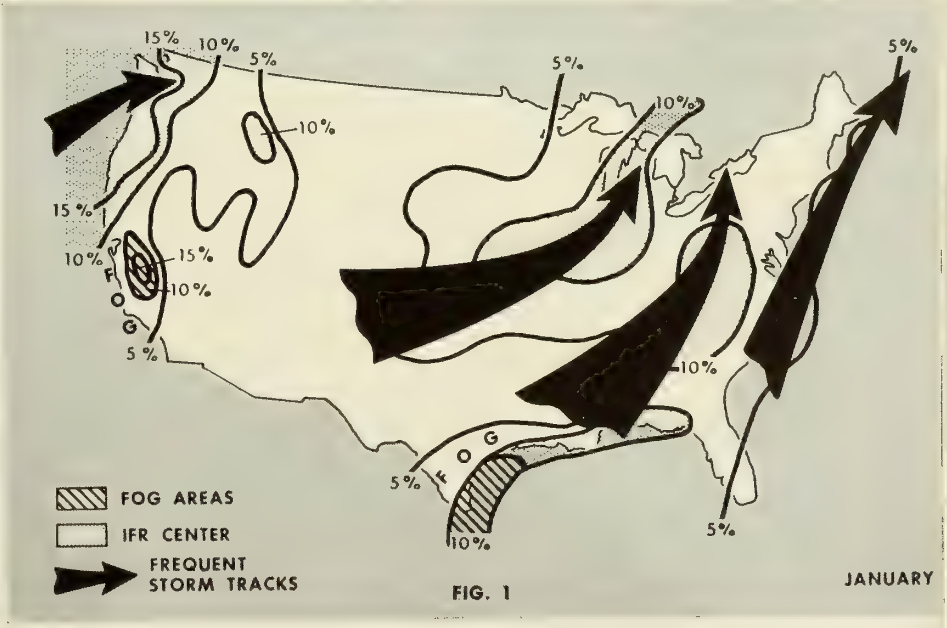


FIG. 1

Above, frequency of ceilings and visibilities of less than 500 feet and/or one mile. Below, shows area of gusty winds and slick runways. Notice the 180-day frost line.

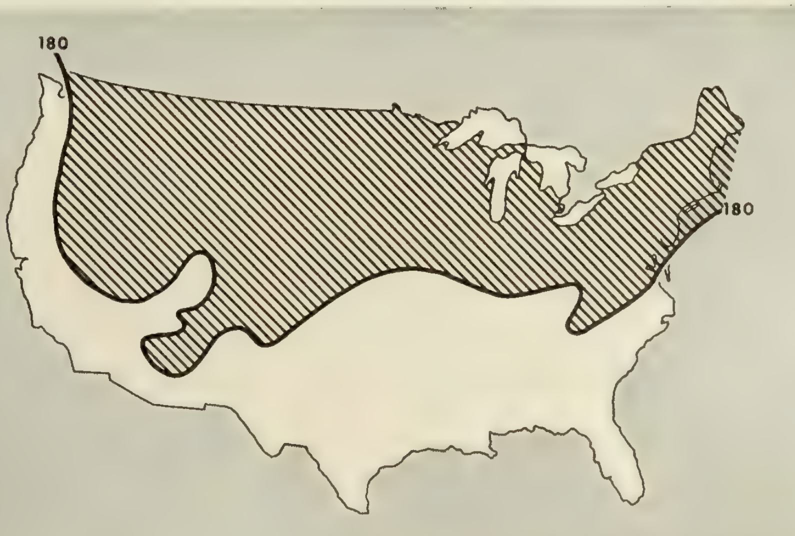


FIG. 2

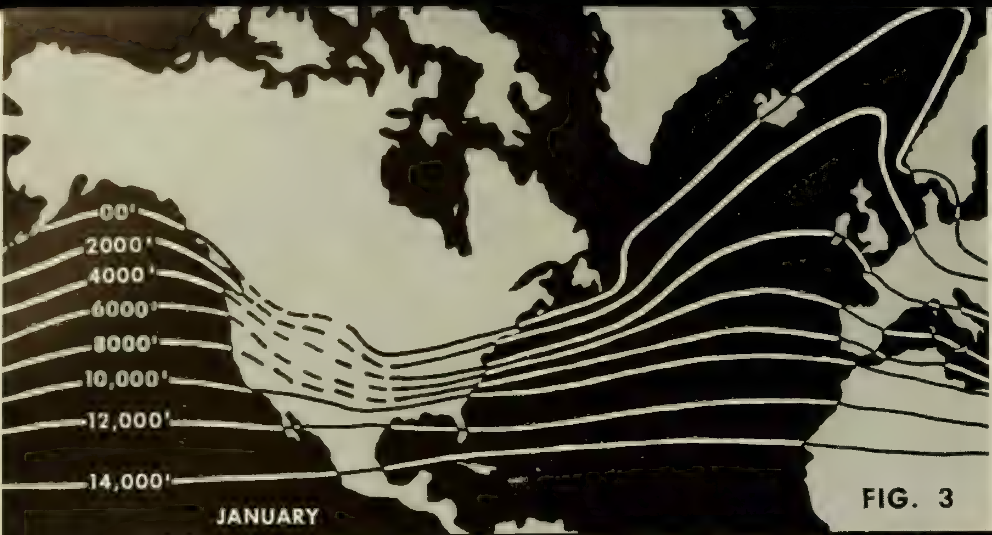


FIG. 3

Left, indicates mean heights of zero degree temperatures above which icing can occur.

Below, shows mean heights of coldest temperatures. Icing is present below these levels.

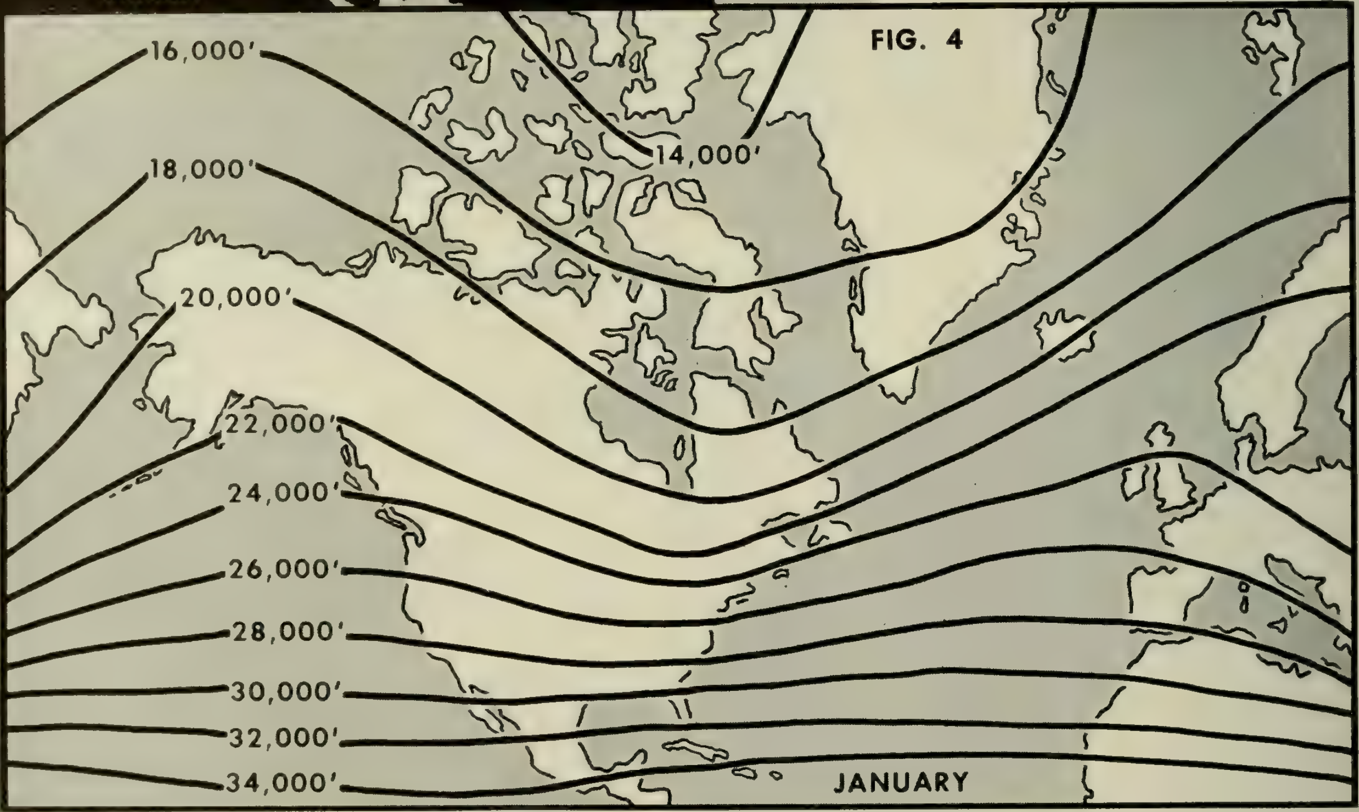


FIG. 4

the Figure 2. Beware that low blow with a snow job.

Nobody knows for sure just what is the potential incidence of aircraft icing. The accumulated figures are biased because pilots are biased; they avoid the stuff. There are just not enough old, bold pilots collecting that kind of hairy frost on their "punkin" heads to make a fair sample.

Recent Tests

During a recent winter, however, over 600 icing encounters during routine flights over North America were assembled and analyzed. The conclusions are interesting, and here they are. Read and heed.

50 per cent of the icing conditions were intermittent.

90 per cent extended over a distance less than 120 miles.

90 per cent of unbroken icing conditions extended less than 50 miles.

90 per cent of vertical icing cloud traverses were less than 4500 feet.

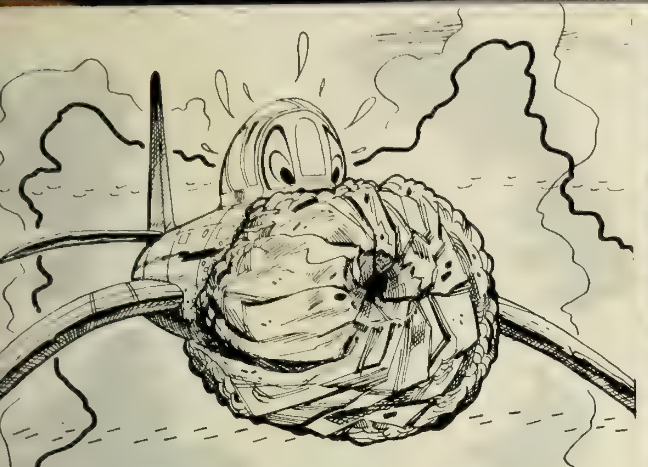
93 per cent of the ice accumulations would have been two inches or less in thickness.

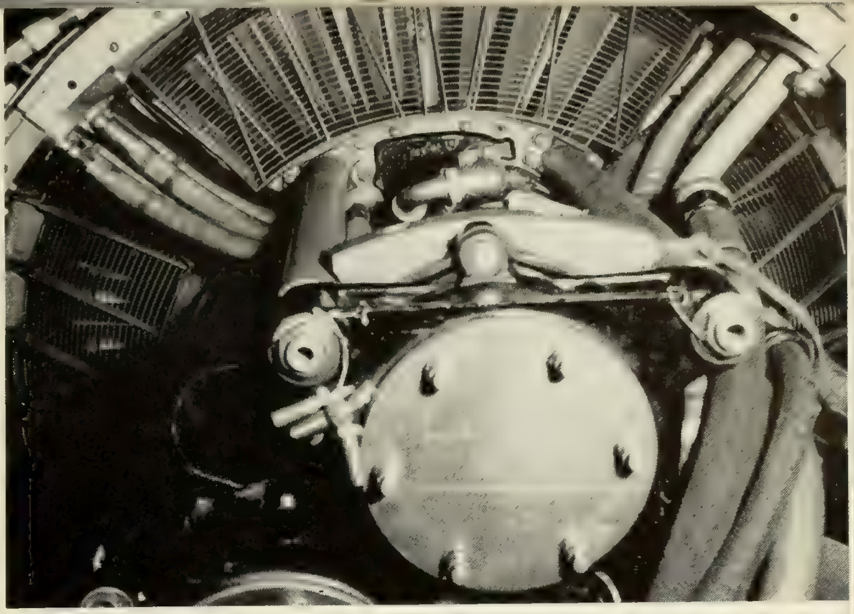
90 per cent of the temperatures in icing were above −15°C. (+5°F.)

Greatest observed potential ice accumulation (without removal) was six inches; longest flight in icing conditions was over 400 miles.

Since most difficulty with ice in flight can be expected in clouds or rain at temperatures just below freezing, the map of mean freezing level heights, Figure 3, shows you where to expect this layer in January. The companion map, Figure 4, of mean heights of −40°C., indicates the levels above which you can reasonably expect to avoid icing (for average conditions). You would collect no ice at these high altitudes because the moisture should all be ready-frozen. Actually, planes should be free from icing quite a bit below these altitudes; the lowest icing temperature found in the 600 cases discussed was −27°C.

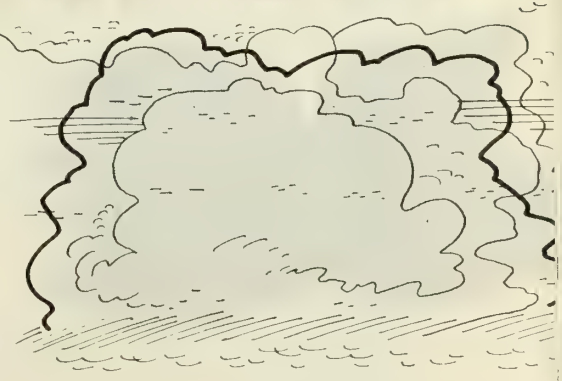
Do you have enough fanny-freeze protection? Check with your local forecaster. ●





With extended screens, severe restriction of airflow can occur in 15 seconds.

ICE . . . in the mill



IT HAS BEEN some one-half decade since a gaggle of F-84s took off from a midwestern base, entered the clouds and began smartly flinging pieces of turbine wheels (in assorted shapes and sizes) all over the State of Indiana. Now this proved disconcerting to others as well as to the '84 chauffeurs involved. In fact, it was reported that the incident brought about an orderly, yet considerable, increase in "early out" requests among the hard hat set.

Investigators, quick to realize the seriousness of the personnel situation, pulled out all chocks and came up with the accident cause (and solution to same) in record time. It all centered around jet engine icing.

Anything that will cause an aircraft to suddenly fall out of the sky is a rather important, as well as frightening, thing. Such is the case with jet engine icing.

When it comes to being a ready-freddy for this sort of thing, one can't beat knowing the Dash One. Therein you will find the procedures and equipment that applies to your particular bird. But, regardless of what you fly, there are a couple of major icing problems applicable to most models of axial flow engines. Either one of these problems can make the mill go all to pieces. (Centrifugal type engines are relatively immune to icing and will not be discussed.)

The first one is the formation of ice on the induction or engine components which greatly restricts airflow to the engine.

The second major problem is the swallowing or ingestion of chunks of ice by the engine.

Airflow Restriction

Let's dig into the airflow restriction first and see what happens and what we can do about it. This is the type of engine icing that snafued those Thunder Jugs.

As the hot pipe you are herding noses through the soup, ice may form on the fixed inlet screens or the inlet guide vanes, thus restricting the flow of air to the engine. This causes a loss of thrust along with an increase in exhaust gas temperature. The fuel control system, sensing the power loss, automatically increases the fuel flow. This increase in fuel and reduced airflow causes a severe overheat condition in the turbine section and unless immediate corrective action is taken, the turbine buckets make like .50 calibre slugs, *tout de suite!*

Ice build-up on inlet screens can cause severe restriction of airflow in as little as 15 seconds and turbine wheel failure in less than one minute. Almost all of the inlet screens now in use are retractable and should never be extended when icing conditions seem evident.

The restriction of airflow caused by ice on the inlet guide vanes takes a little longer but can still louse up the works (engine). Blocking of the air passage between the vanes can occur within four minutes. The indications are the same high exhaust gas temperatures and all too often this is the only indication prior to complete engine failure.

Inlet duct icing can occur without the formation of ice on the external surfaces of the aircraft. When you make good a true airspeed of less than 250 knots at a high power setting such as during climb, the intake air is sucked rather than rammed into the compressor inlet. This suction causes a decrease in temperature of as much as 5°C. Thus, air that is above freezing may be reduced to sub-freezing temperatures as it enters the engine and inlet duct icing will occur.

Ice Ingestion

The compressor failure problem due to the swallowing of ice happens when ice formations break from the cowl lips or nose dome and are swept into the engine by the airflow. The damage occurs when a chunk of ice passes between the inlet guide vanes and hits a rotor blade. The impact causes blade oscillations and it is possible that the leading edge of the blade will scrape the trailing edge of the inlet guide vanes, bending or chipping the rotor blades. It also is possible that the blade will snap off, and there you are—a foreign object kicks through the compressor, causing disintegration.

An example of ice ingestion damage occurred in a B-47 during an icing test flight. After flying through icing conditions, the pilot pulled up above all clouds and noted about an inch of ice on the engine nacelle lips. A few minutes later the ice broke off, entered one of the air intakes and caused engine compressor failure. The pilot landed the aircraft safely and the other five engines were examined. All of them showed ice ingestion damage. The best of the five engines was placed on a test stand and it ran all right at low rpm. However, when it was run up to 92 per cent, the engine compressor failed in approximately two minutes.

Ice ingestion damage, therefore, can take two forms. It can cause immediate compressor failure or it can result in compressor failure at some later date. This type of icing is insidious because it can result in engine damage even after the aircraft leaves the icing condition and flies in the clear.

Anti-icing Systems

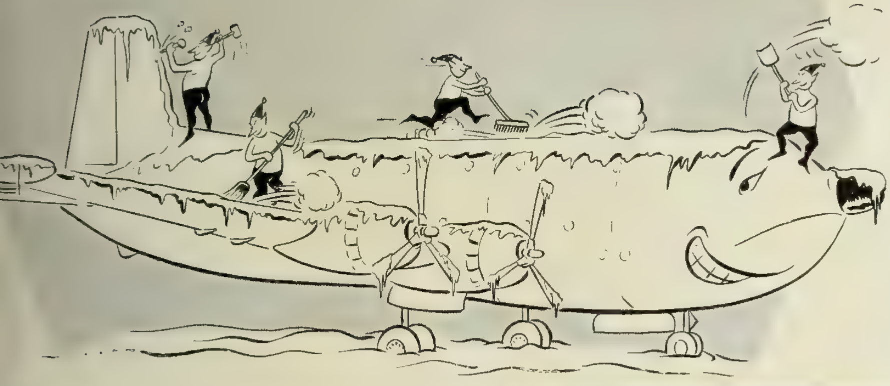
To eliminate engine damage caused by icing, anti-icing systems have been devised for most Air Force aircraft. One system incorporates an alcohol spray mechanism to eliminate or prevent ice formation and the other system heats the induction and engine components by electrical means or compressor bleed air. The latter is the most common.

In the aircraft using compressor bleed air, the problem is not entirely solved. At low engine rpm the anti-icing system usually becomes ineffective because of the reduced pressure and temperature of the compressor bleed air. During a letdown with the throttle retarded, it is possible for ice to form on the inlet components. As a result, a technique known as throttle-burst has been developed. This is nothing more than shoving the go-handle forward every minute or so. This introduces a surge of heated air through the components. Keep in mind that this "burst" must be done often enough so that the ice does not build up and become a potential ice ingestion hazard.

No doubt about it, icing danger to the power plant of your jet bird is real, and its results drastic. If your aircraft has protection, be sure to use it, and keep an eagle eye on that tailpipe temperature. If it starts to make its move, get on that throttle, reduce power as necessary and change your altitude to get out of the clouds. T. O. 1-1-469, "Operation of aircraft with jet engines under icing conditions" has a lot of information on the subject. Comply with it, along with your Dash One and reserve the ice for the tall glasses—not your jet engine. ●

Regardless of the bird you fly, know your anti-icing procedures. They are in the Dash-One.

ON THE SURFACE



W. B. McVeigh
Douglas Aircraft Company

Don't be fooled into thinking ice or snow on the surfaces of your aircraft will melt or blow off. Don't settle for less than a clean, ice-free wing.

WINTER WEATHER is demanding, both on our man-power and our flying machines. If you're the member of a crew who has neglected the common sense precautions and procedures for dealing with ice and snow, it's nine chances out of ten you'll be in the midst of a real action-packed drama before very long.

An airplane covered with snow is a booby trap. Don't be fooled into thinking the stuff will be blown off before the monster becomes airborne. Facts taken from the case histories of many winter accidents disprove such wishful thinking. Ice is where you find it, and in all probability you will find it on the surfaces under that nice, white blanket if you're smart enough to look.

Prevention

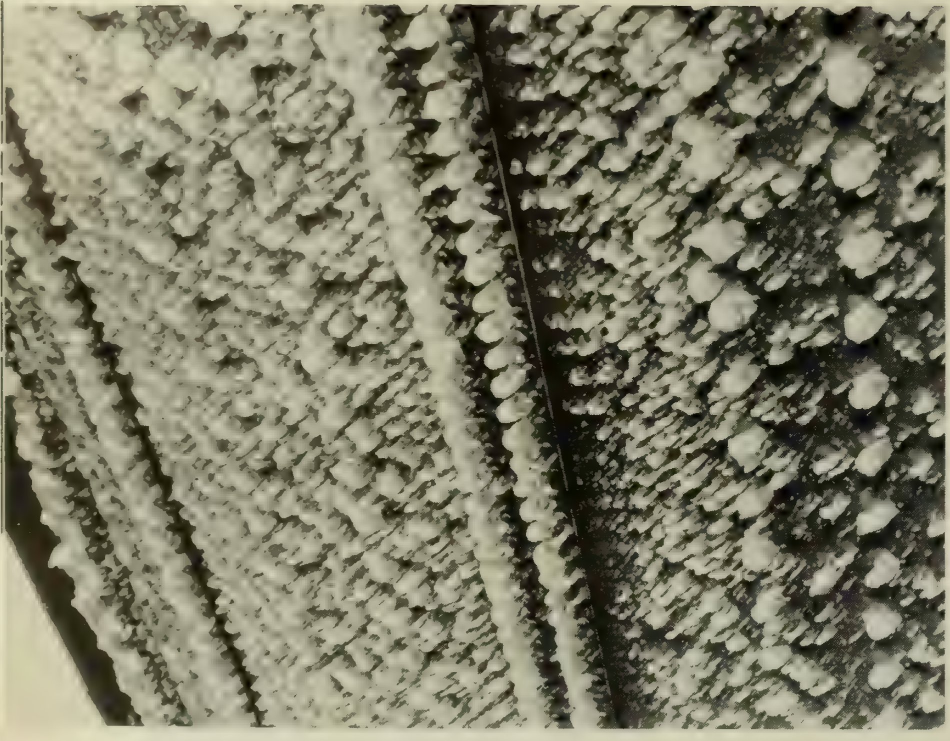
The old adage "An ounce of prevention is worth a pound of cure" most certainly applies to frost, ice or snow, where aircraft are concerned. A preventive measure to be taken in lieu of inside storage, is the use of fabric covers or some other suitable protective covering on the aircraft surfaces. A little time spent in covering the surfaces in the face of adverse weather will be repaid a hundredfold when the airplane is readied for flight.

The effect of snow or ice in all forms is very difficult to predict and too many variable factors are involved which would make any such prediction unreliable. As we all should have learned, the airplane is dependent upon smooth, uninterrupted airflow over all of its surfaces for safe, efficient flight. Then, and only then, is the human element in complete control of the aircraft.

The main effects of ice or snow on an airfoil are to disturb the normal airflow over its surface and alter the distribution of weight. This can result in increased drag, loss of lift, decreased control, flutter of the surface or all of these factors combined in varying degrees. The vital factor is the distribution of the ice or snow formation on the surfaces rather than the additional overall weight increase to the aircraft. The formation of ice or snow creates changes in airfoil contour, control and servo-tab surface mass unbalance which may lead to separation of airflow and in some extreme cases, dynamic instability of the surface.

If the ice formation is unsymmetrical, then large differential loads between two lifting surfaces may develop to a point that the aircraft may no longer be controlled. Ice formation on the leading edge of a control surface or servo-tab also creates a potential buffeting condition. This is particularly true at surface deflections where the iced portion of the control surface leading edge protrudes above or below the trailing edge of the primary surface.

Control surface buffeting caused by an unbalanced condition should be readily and easily distinguished from



The vital factor is the distribution of ice formation rather than the additional weight increase.

buffeting of the surfaces caused by the approach to a stall. If the condition is eliminated by decrease of airspeed, it is indicative of structural shake which may be attributed to control surface unbalance (inertia effects) rather than aerodynamic disturbance (stalling) of an airfoil section. Stall buffet is generally eliminated by increasing rather than decreasing the airspeed.

In addition to the many other adverse effects of ice accumulation on control surfaces, it is evident that the resultant tail heaviness and subsequent loss in flutter stability deserve special attention.

Let us consider a recent incident involving a C-124 Globemaster. Indications are that the difficulty occurred as a result of elevator ice accumulation prior to take off from Misawa to Tachikawa, Japan.

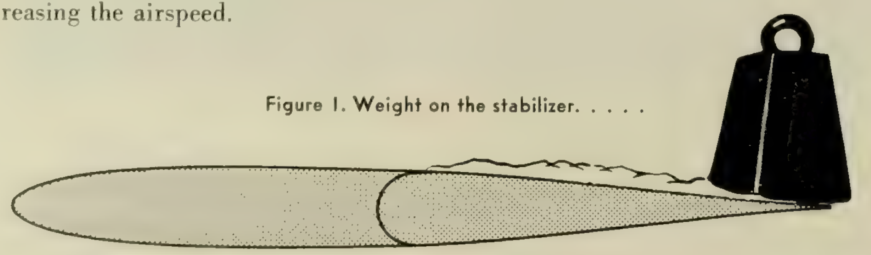
The gross weight of the aircraft was 156,656 pounds. It had been on the ground at Misawa for approximately two hours in blowing snow, at an outside temperature of 33°F. The right wing heater did not operate on the ground and no action was taken to remove the snow and/or ice which had accumulated on the aircraft. The pilot indicated he did not believe sufficient accumulation existed on the surfaces to warrant removal.

Takeoff

The takeoff speed appeared normal and as the aircraft climb approached 500 feet altitude, with gear and flaps retracted, engine power reduced to METO and at approximately 150 knots IAS, a light to moderate "shake" was felt and described by the pilot as being in the horizontal rather than the vertical plane. Immediately, five degrees of flap was extended and the "shake" ceased. After a change of flight altitude was granted at 8000 because of icing, the climb was continued to 10,000 feet. At 8,000 feet, the right wing heater came into operation and all heaters were then operating normally. Shortly after leveling off at 10,000 feet cruising altitude with cruise power and 175 knots IAS, a violent "shake" in the horizontal plane was experienced. Power and airspeed were reduced immediately to 165 knots IAS and flaps were again extended to five degrees, after which the "shake" ceased, and the flight continued to Tachikawa without further incident.

Upon inspection of the aircraft immediately after the flight, shearing of the right elevator torque tube bolts

Figure 1. Weight on the stabilizer. . . .



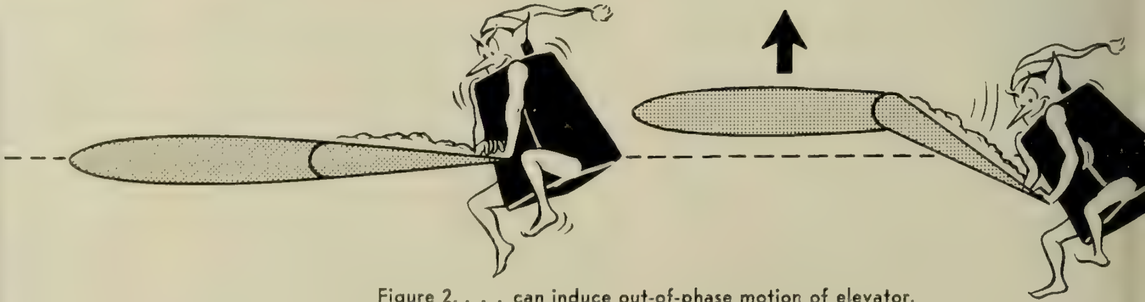


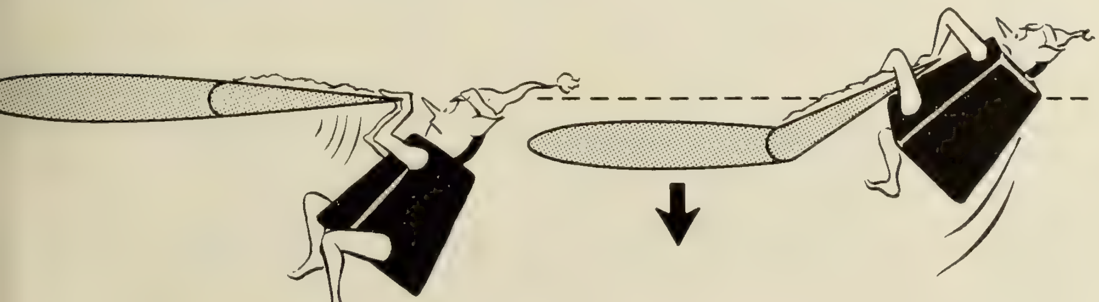
Figure 2. . . . can induce out-of-phase motion of elevator.

If you have wing covers available, better use them. It is easier and safer than the broom treatment.

was revealed, and severe major structural damage to the fuselage shell was in evidence in the empennage area.

The conclusion drawn after a thorough investigation of all the facts surrounding this accident, was that the most probable cause was icing of the horizontal tail surfaces which resulted in surface mass unbalance and dynamic instability of the surfaces. A flutter analysis of the stabilizer-elevator system including the effects of ice accumulation, discloses the following highly probable sequence of events responsible for this incident:

- Prior to takeoff, approximately 0.15 inches of ice accumulated on the elevator surfaces. This caused the



Taking off in a big iron bird or a sleek, fast fighter requires a wing clear of ice and snow.

center of gravity of the surface to shift seven inches to the rear of the elevator hinge line.

- At the reported 150 knots IAS, elevator flutter was experienced. This occurred as a result of a coupling between the tail-heavy, anti-symmetric vibration mode of the elevator at four cycles per second, and the anti-symmetric fuselage torsion-horizontal tail bending mode at three cycles per second. (Anti-symmetric refers to the port surface moving opposite to the direction of motion of the starboard surface.) The resultant flutter was primarily reflected in large amplitude oscillations of the elevators, leading to the failure of the torque tube between the surfaces reported subsequent to the incident.
- Upon failure of the torque tube bolts, the loss in restraint between the two surfaces dropped the frequency of the anti-symmetric elevator mode below the frequency of the fuselage torsion mode and resulted in momentary stability.
- As the speed was increased to the reported 175 knots IAS, flutter was encountered once again at a somewhat lower frequency of the fuselage torsion mode. The resulting large amplitude bending oscillations of the horizontal tail and associated torsional loads imposed on the aft fuselage caused the structural failures reported in that area of the aircraft. The fact that the flutter did not lead to the destruction of the tail and stopped abruptly, must be attributed to the ice breaking free of the elevator surfaces, thereby stabilizing the system.

Flutter

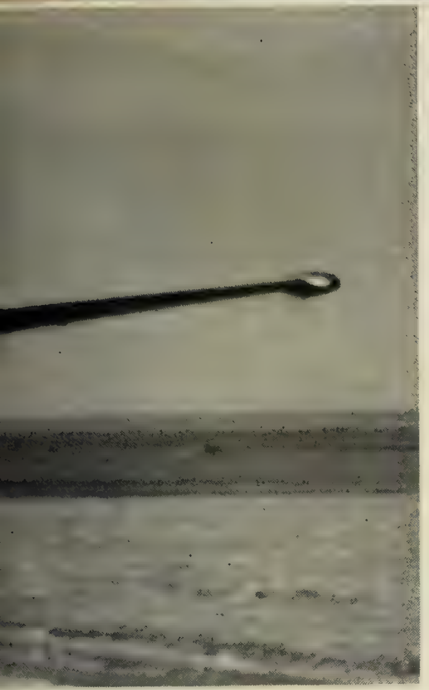
In an attempt to explain the forces at work in the mechanism of stabilizer-elevator flutter, let us consider a cross section of the horizontal tail surfaces with a weight placed at the trailing edge of the elevator as shown in Figure 1.

When the stabilizer translates (bends) up and down, the trailing edge of the elevator tends to remain fixed, due to the presence of this weight as shown in the series of movements in Figure 2. The relative motion of the elevator to the stabilizer is observed to be "out of phase," i.e., when the stabilizer bends upward, the elevator effectively rotates trailing edge downward and vice versa.

This "out of phase" motion of the elevator produces an aerodynamic lift force on the stabilizer which tends to drive the stabilizer in the same direction that it is moving. The phase relationship between the aerodynamic force and the motion of the stabilizer causes a net amount of energy to be fed into each cycle of oscillation. As a result, the amplitude of the stabilizer deflection increases with each cycle and may lead to the total destruction of the surface.

When the elevator is "mass balanced" the center of gravity of the elevator weight is made to act through the hinge axis, thus preventing the "out of phase" elevator to stabilizer motion responsible for this type of "tail wagging the dog" flutter. The control surface mass balancing "fix" has been standard aircraft design practice since the problem was first encountered on the World War I vintage aircraft.

The importance of clean airfoil surfaces cannot be emphasized too strongly. As previously stated, it is practically impossible to predict the



effect of foreign substances on aircraft surfaces, even water. To illustrate this point let us turn to the accident reports and take the case of the C-47 pilot who, upon preflight inspection, observed the airplane to be covered with a thin layer of water. Discounting the danger of water, he loaded 21 passingers aboard and took off. When approximately 15 feet in the air, the plane lost altitude and started a turn to the left; the pilot applied right aileron and pushed the throttles forward. The left wing came up, but the right wing immediately dropped. The airplane then made contact with the ground about 200 feet beyond the end of the runway with the gear still extended and crashed into a snow-bank. The water on the surfaces of the aircraft had frozen when it had entered a colder layer of air above the runway, spoiling the ability of the wings to produce lift. Another case of ice wresting control of the aircraft from the pilot. If a thin layer of ice would have such a disastrous effect on control of the aircraft, it can readily be seen what hazardous proportions any appreciable building-up might have.

Complete Removal

There are many conditions which enter the problem of prevention or removal of ice, snow or frost deposits. It is not the intent of this article to elaborate further on these conditions, except to say that appropriate and systematic plans should be promulgated and followed which will insure safe, uninterrupted flight operations during any adverse weather conditions. Personnel who must cope with the problem should be thoroughly familiar with all the aspects which are entailed to aid them in making the proper decision.

The removal of foreign deposits from critical surfaces should be complete. Broken or irregular pieces of ice remaining may create a greater disturbance than the original formation. The best policy is to remove *all* deposits from both top and bottom of wing and tail surfaces and from the fuselage as well. *Dry snow should not be left to blow off during the takeoff run.*

Experience shows that dry snow tends to cling to airfoil surfaces and usually will prevent a successful takeoff. So far as controls are concerned, snow can sift into the smallest openings and either freeze the controls in one position or become packed so that movement may be restricted later. It also might be well to remember that even though the aircraft is outwardly clear of ice and snow and takeoff is attempted on a slushy runway, it is good practice to actuate the landing gear through at least one complete cycle after climb has been established. Otherwise, slush thrown into the wheel wells may freeze and prevent extension of the gear for the next landing.

It cannot be emphasized too strongly that, in addition to the regular preflight inspection, a thorough examination for ice and snow deposits be made of the *entire* aircraft just prior to flight. Be sure that—

- All skin surfaces are clean and entirely free of frost, ice or snow.
- Propeller blades and hubs are inspected and any frost, ice or snow are removed.
- All control hinge points and control surface openings are checked for freedom from ice and snow.
- All antennas and antenna fittings are free of snow and ice deposits.
- Nose and main landing gear assemblies, including drag linkage, uplatches and door operating linkages, are clear of ice and snow.
- All heater and supercharger air intake duct openings are clear of snow and ice deposits.
- Engines are warmed up in an area free of slush and moisture, lest the propellers pick it up and throw it back over the wings, tail surfaces and fuselage.
- After engine warm-up, all flight controls are checked through their full arc of travel to make certain that they are not restricted by packed ice or snow in areas where visual inspection is difficult. ●

A fast, one-way trip to them Pearly Gates can be the result of trying to fly with a load of snow.

...OOPS... WRONG SWITCH

Lt. Col. Mitchell J. Mulholland
Safety Research and Analysis Div., D/FSR

This is the fourth of a series of articles prepared for FLYING SAFETY by Lt. Colonel Mulholland. This month he discusses a built-in hazard that affects all of us.

WHEN A PILOT bobbles the ball in any way and an accident results, we normally write it up as pilot error and go on our merry way. Corrective action in these cases frequently consists of such positive and glittering little gems as, "This accident will be discussed at the next flying safety meeting." In other words, the pilot goofed—rap his knuckles, waggle your finger at everybody else, go back to work and wait for the next one to happen.

What have we really accomplished here? Nothing. We have already discussed, in a previous article, the mechanism of human error. Now let's look a little further. We know that man is prone to error. Why then should we knowingly design and tolerate unnecessary booby traps that make human error more likely? And if a human pilot makes an error that is traceable to a built-in booby trap, where does our responsibility lie for corrective action? What do we do—spank the pilot or remove the cause?

A trap to be most effective must be concealed or camouflaged. You would hardly expect an elephant to fall into a pit unless it was covered with grass. It's the same way with the traps that catch the unwary pilot. He doesn't realize they are there. In fact they were designed with something else in mind. The point is, once they are recognized they should be eliminated as quickly as possible before they catch more people.

Some booby traps are so simple and obvious that it almost looks as though they were deliberately built for the purpose. We have seen aircraft with gear and flap controls right next to each other and exactly alike. This simple juxtaposition paid off in innumerable accidents until somebody wised up and relocated the controls. The tiptank fuel system on some of our jets has rolled a lot of pilots into the ground when one tank would feed and the other wouldn't. Assuredly, pilot error has been the primary factor in these accidents, but why the error? Because it was set up, waiting for a pilot to come along.

When we look at an accident to determine its cause, we have to go all the way. It's an absolute obligation that we track the cause factors down so they can be eliminated as causes of future accidents. Obviously, we can't shut the investigation down when we discover pilot error, as if that was the end of the road. What led this pilot to bobble the ball? Did we build something into this airplane or into the procedures that tripped the pilot up? Flying an airplane can be a complicated business at best without stacking the deck against the pilot. So it's our responsibility to find these things and correct them.

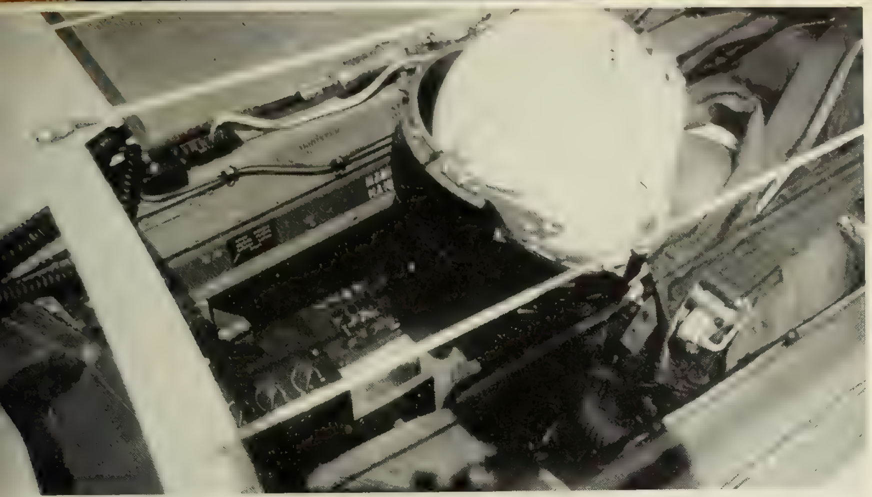
First of all, we can't stop at the obvious things, the handles in the wrong places, the familiar "bugs." We have to follow through the whole operation, the whole sequence of events from the pilot's viewpoint. If we find something poorly designed or a procedure poorly planned, there are two things we have to do immediately—take steps to get the thing corrected, and get the word to everybody to watch for this trip until it's corrected. If we slip up on either of these steps we're not doing our job.

Here's How

How does it work? Let's see. Take a twin-engine airplane that crashes after a double engine failure. Investigation shows that only one engine failed and the crew feathered the wrong engine. A pretty gross error, you say? Our job is to figure out *why* such an error was committed—why the pilot booted this one so badly. First, let's find out whether he really *knew* which engine failed. If he can't tell us for sure, let's duplicate the condition to find out.

Take a similar bird up, concentrate on the gages and have the pilot chop one on you. Right now—quick! Which engine? If you get the least bit mixed up, analyze why. Figure out what kind of an instrument or control configuration would eliminate confusion. If there's no question in your mind as to which engine quit, go on from there, remembering that the pilot in an emergency is under strain. Where does he reach for what? What does he do? Is there a trap lurking along the way? What would lead him to shut down the wrong engine and feather?

Remember the old fuel shut-off valves in the B-25? Instead of being side by side—left and right, self-ex-



When IFR, duck your head down and to the side to select channel. A perfect set-up for vertigo.

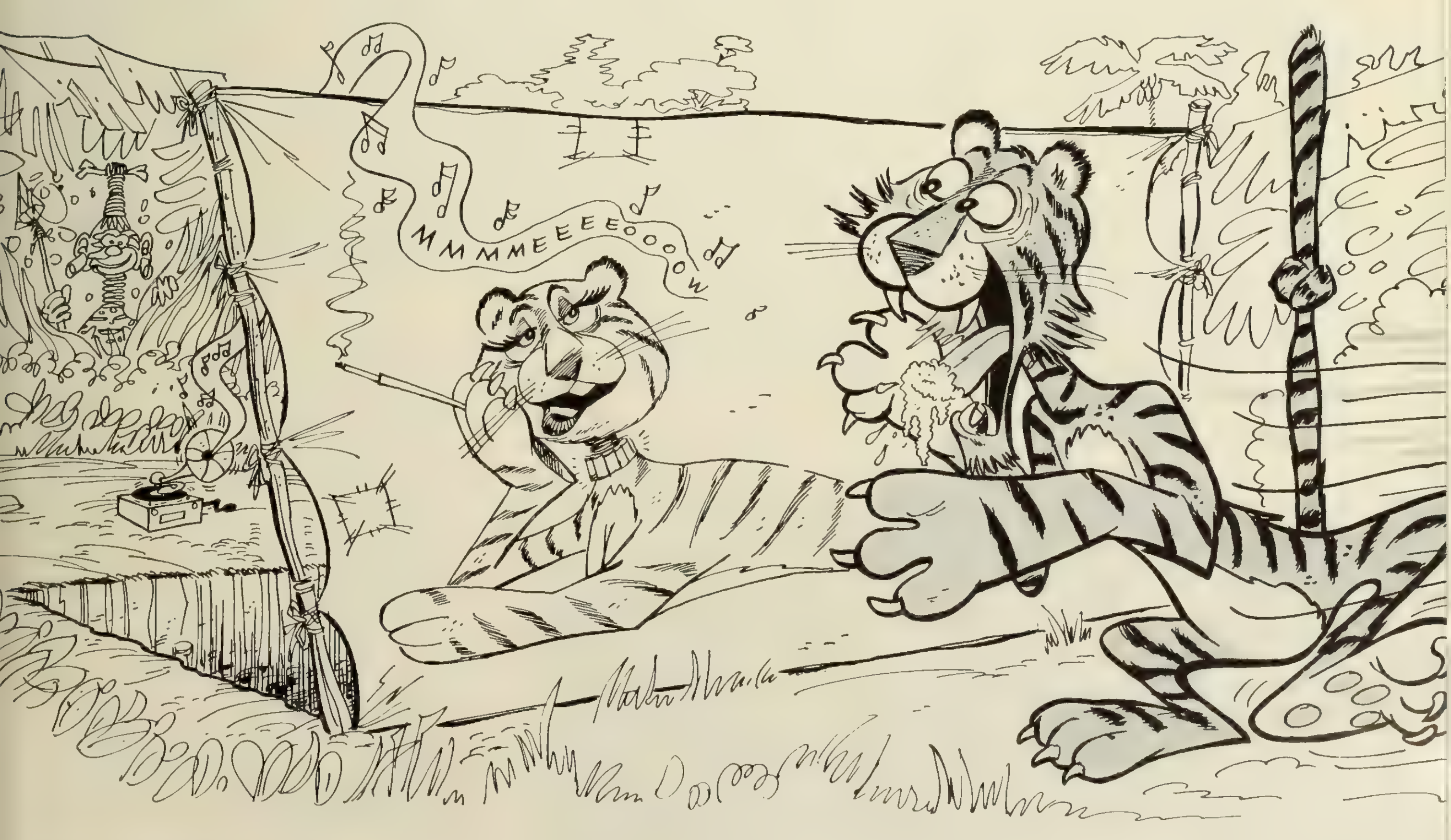
planatory, they were installed along the side wall to the left of the pilot, one in front of the other. As the pilot turned his head to look at them, he would rather expect to find the right shut-off toward the front and the left toward the rear. But they weren't that way—they were just the opposite. Try that for size on a night climbout sometime, with an engine fire cooking up. Act fast—shut off the fuel—oops! Wrong engine. This was corrected, but it took time—actually too much time.

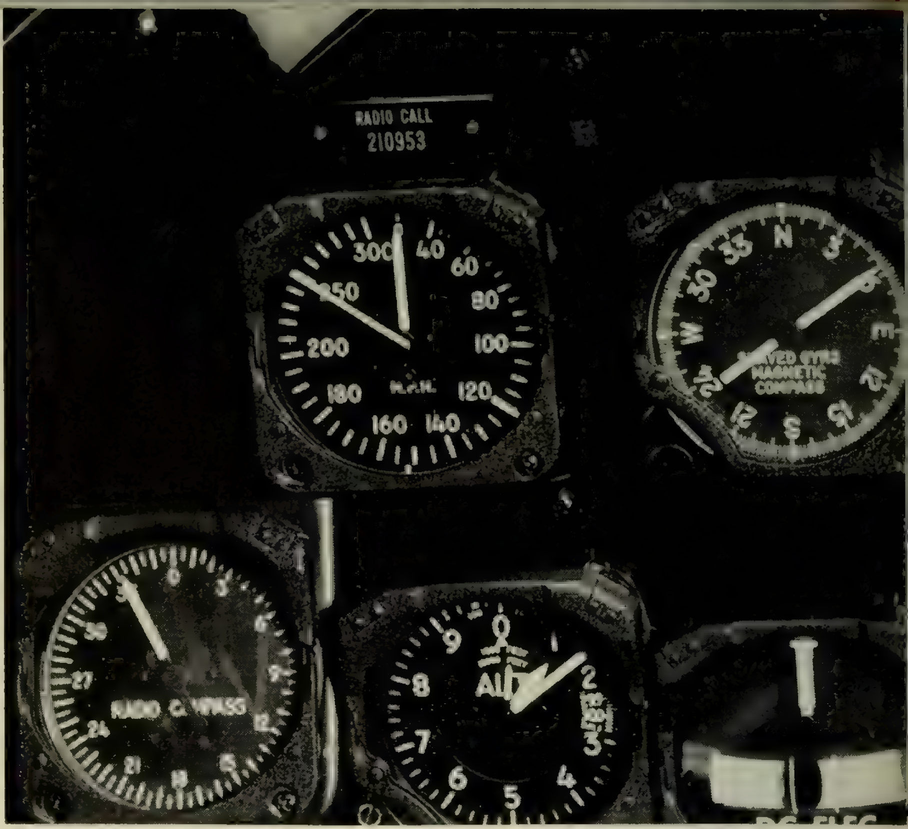
A gadget in the cockpit may seem perfectly harmless and simple to operate—*until* we consider the circumstances under which the pilot is going to use the gadget. Look at the radio installations in some of our fighters. Way down on the right side of the cockpit. Sure you can reach it, you can see it, you can tune it in when you're sitting on the ground. But get up in the soup some night making a penetration in rough air. You're watching those gages like a hawk, making descending turns—then you have to change frequency. Maybe it just means changing a UHF channel, maybe it means retuning the ADF. Whatever it is you have to get off the gages, duck your head down and to the side, and try to see the gadget. A beautiful set-up for vertigo, disorientation or downright confusion.

That same line of thought applies to emergency procedures or emergency systems. By its very nature an emergency system is going to be used in a time of stress, so a little applied psychology should be used in designing it. Its operation should be simple and logical. When something fails, the subsequent action of the crewmembers concerned should be natural and in a sensible sequence. Handles that have to be pulled, switches that have to be engaged should be clearly labeled, logically located.

The attitude should be this: The pilot's in a jam, let's make it as easy as possible for him. More than that, let's look at it this way—the equipment we gave the pilot was supposed to work for him. If it has failed, are we going to compound his troubles by giving him a complicated, and

A trap to be most effective must be concealed or camouflaged.





On the ADF, turn right and needle moves left. Remote indicating compass works the other way. Use these instruments on beacon letdown and you'll know what it's like to be mentally crosseyed.

confusing emergency procedure to contend with in his time of trouble?

There are few people so alone as a pilot upstairs with an ailing airplane. Supervisors, engineers, instructors, designers and flying safety officers are all comfortably on the ground. Joe Pilot is up there wrestling alone with his emergency. Once he is on the spot there is little we can do to help, but if we thought about him when we designed the bird and planned his procedures, we can at least feel that we haven't made life unduly rough for him at this point.

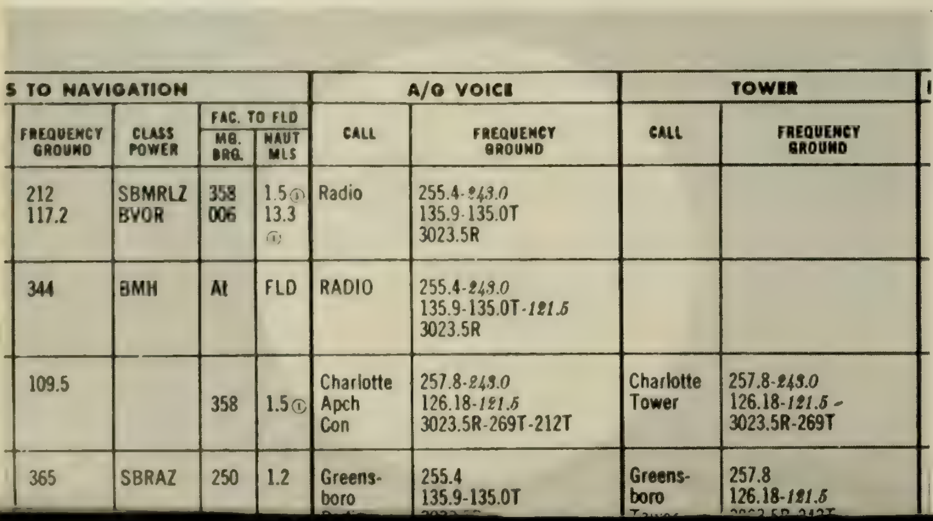
You will note we say, "planned his *procedures*," not just his equipment.

By way of illustration of how equipment and procedures can be combined to keep a pilot as busy as a one-armed piano tuner with hives, consider the innocent, inoffensive little C-45H. About as simple an airplane as you can find, and reasonably honest. Okay, put it in the soup and go to work. First of all you are going to have a full time job just keeping the thing right side up, particularly if there's any turbulence. That we can't do much about. But here are two fine little dials in front of you to keep you informed about your course. The ADF indicator, tried and somewhat true, works the way it has for years. Turn right and the needle moves left. Turn back toward the needle and it comes back to meet you. Fine—this we have lived with for a long time, but what's with this other dial? The remote indicating compass is so rigged that it works the other way. Turn right and the needle moves right. Turn toward the needle and it moves farther off. A small point? Work with it and you'll get used to it? Maybe so, but why is this necessary? Try using these two instruments on a beacon letdown, stir in a little rough air, and you'll know what it's like to be mentally crosseyed.

Next—this is a modern airplane, so it has UHF. A nice little black box with channels neatly marked from one to 18. So look in the Facility Chart to see what frequency you have to use to contact somebody. Does it tell you Channel 4? Of course not—it tells you 257.8 mc. Channel 15? No, it's 363.8 mc. This is too complicated so you try VHF — after all you have eight nice little red buttons lettered A through H. What does the chart tell you? Channel A? Of course not —now it says 135.9—135.OT. Well, after all, you can figure all this out —you have a little card posted somewhere, either on the ceiling or folded under the windshield, that lists all these frequencies for you. It's easy, just read them off. Of course the people who printed the card are apparently the same people who engrave the Lord's Prayer on the head of a pin, and anyway there's no light near the card so you can't see it at night unless you blind yourself with a flashlight. Flashlight? Heck, that rolled way under the seat eight bumps ago.

All right—you resign yourself to the problem and proceed — but of course you must make position reports. These involve estimated time at the next reporting point. So while flying precision instruments with this bouncing bird, you must check the clock, compute your speed since the last check point, apply that to the distance to the next, add it up on the clock — remembering to convert all figures from miles per hour to knots or vice versa, grab the mike and tell the man all about it. Of course, you probably won't be able to make yourself heard for some time because conversation on the radio is running pretty heavy and general. When you do make contact, chances are good that the man will come back and ask some ridiculous question like "Request your estimate over West Gate," which involves a frenzied search of the Facility Chart to find West Gate. This of course turns out to be merely an intersection, involving a good deal

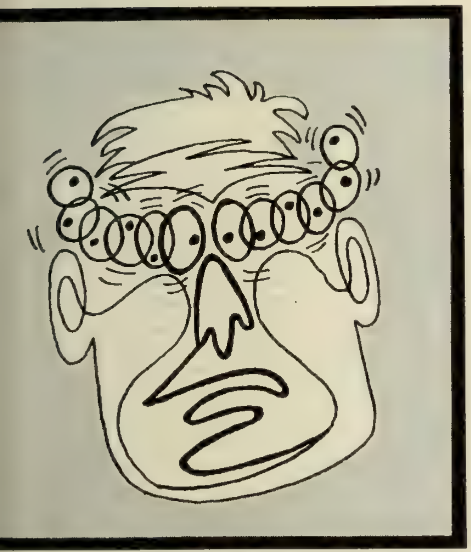
Look at the Radio Facility Charts to find a frequency. Does it tell you Channel 15? Never.



S TO NAVIGATION				A/G VOICE		TOWER	
		FAC. TO FLD					
FREQUENCY GROUND	CLASS POWER	MG. BRG.	NAUT MLS	CALL	FREQUENCY GROUND	CALL	FREQUENCY GROUND
212 117.2	SBMRLZ BVOR	358 006	1.5① 13.3 ①	Radio	255.4-*243.0* 135.9-135.0T 3023.5R		
344	BMH	At	FLD	RADIO	255.4-*243.0* 135.9-135.0T-*121.5* 3023.5R		
109.5		358	1.5①	Charlotte Apch Con	257.8-*243.0* 126.18-*121.5* 3023.5R-269T-212T	Charlotte Tower	257.8-*243.0* 126.18-*121.5* - 3023.5R-269T
365	SBRAZ	250	1.2	Greens- boro	255.4 135.9-135.0T	Greens- boro	257.8 126.18-*121.5*

more leg work around the cockpit. To complicate matters further, you then discover that West Gate is an intersection of a low frequency range leg and a VOR radial, and naturally you do not have Omni in the airplane. Right now it doesn't make much difference because (a) you have just gotten into precipitation and the ADF needle has gone haywire, and (b) you can't answer the man anyway because the man is having a long chat with somebody else about an ATC clearance. This is as good a time as any for a little carburetor ice to show up or better yet to have one of the tanks run dry, the fuel gage having been unnoticed during the confusion.

A few years ago a couple of London omnibuses and their crews toured the United States as a good will gesture. In New York one of the British conductors was appalled to note the absence of conductors in the New York buses. He watched the driver making change, issuing transfers and incidentally driving, and concluded, "'Ow can 'e keep 'is mind on 'is job if 'e 'as to do sums in 'is 'ead?"



Are we asking Joe Pilot to do the impossible by requiring him to do too many "sums in 'is 'ead?" 'E 'as enough to do—pardon, he has enough to do just driving the machine and reading his instruments without overdoing the mathematical gymnastics.

What route can we use to come to his rescue? Design—of both equipment and procedures.

Let's first consider the monstrous panel of instruments confronting the pilot. The obvious fault that hits us right away is the multiplicity of gages. Too many of them, can't they be simplified and consolidated? This of course can be done—not that it *is* being done, but it's obviously necessary. The bigger fault though lies deeper. We give the pilot all these gages, but are they really telling him what he has to know? If they are presenting the material he needs, are they presenting it in terms that he can use? Let's look and see.

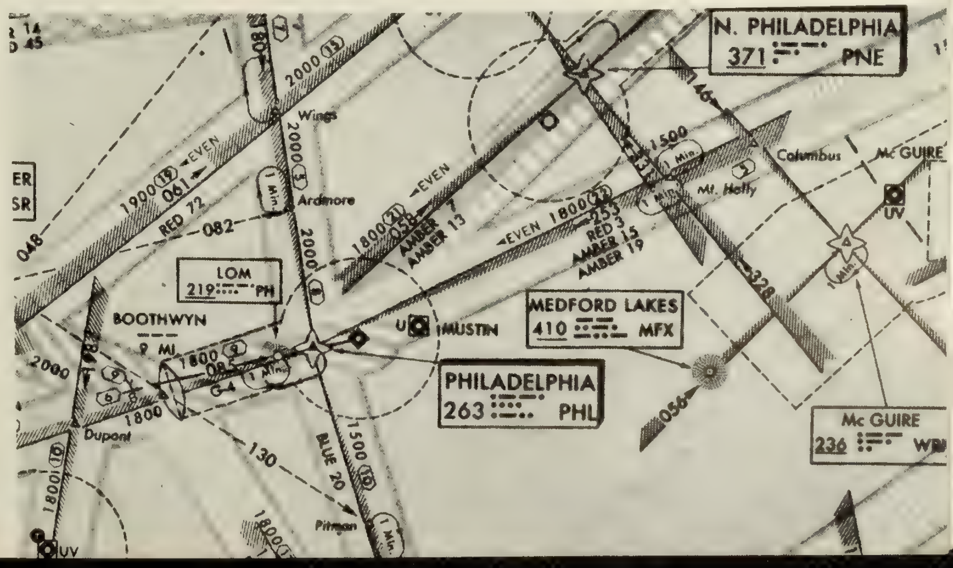
The Whole Picture

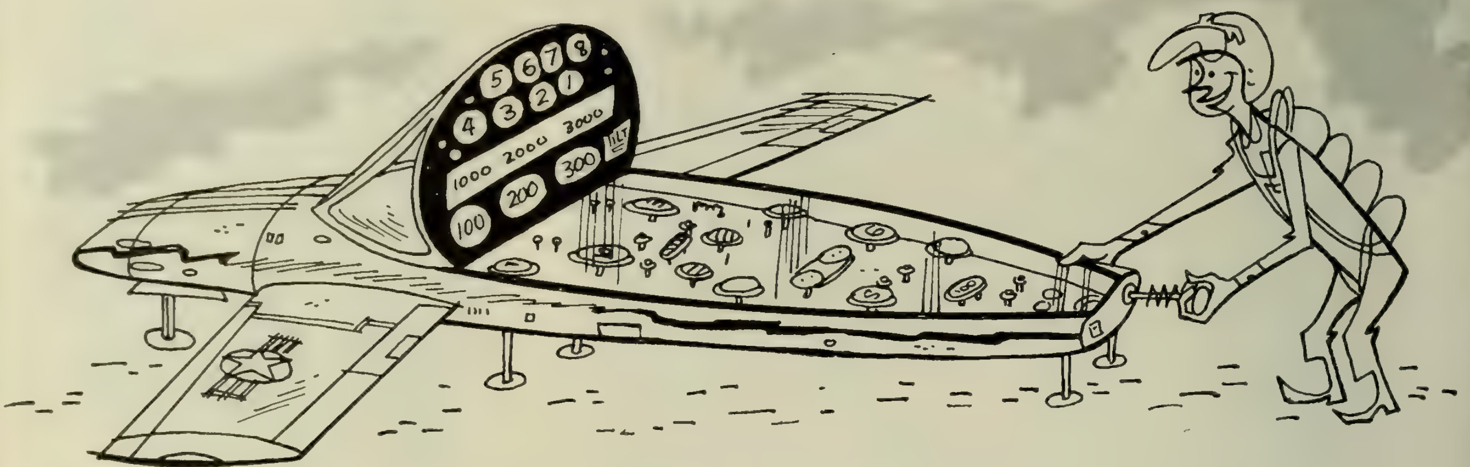
- *Engine power.* This the pilot has to know, accurately. For years we have given him tachometers which only tell half the story, so we need manifold pressure gages to fill in the picture. Now, realizing that even the combination fails to get the whole message across, we give the pilot torque-meters. Of course we provide new alternatives of wet or dry power and add such variables as vapor pressure, so that now the pilot has three instruments per engine to tell him one thing, and still has to do sums in 'is 'ead to get the figures on which to base decisions.
- *Speed.* This simple but vital little quantity might just as well be presented to the pilot via a crystal ball. It's a rare condition of flight that allows Joe Pilot to read his actual speed on an indicator without going through some kind of numbers game. Technologically, our pitot-static airspeed indicator has progressed not one whit since the days of the Keystone bomber, and our present operating altitudes have made it a virtual anachronism. To muddy the water even more, we converted our charts and measurements to nautical miles some time back, but have still not gotten around to converting the instruments in the bulk of our older aircraft. So to the conversions for altitude, temperature and instrument error must be added the mathematical ping-pong between knots and miles per hour. Finally, the most critical aspects of airspeed, those of takeoff and approach speeds in our larger airplanes, all involve computations of weight and other variables before the information on the dial really means anything.

A monstrous panel of gages faces the pilot.

- *Altitude.* Much has been said and written, and something has finally been done about the medieval presentation of the 10,000-foot scale on our altimeters. This at least is being rectified, but how about the basic inaccuracies of the barometric altimeter?

"Request your ETA over Wings." How long does it take you to find it? Is it an intersection?





When we allow warning lights to fill a cockpit until it resembles a pinball machine, this way lies madness.

Above 20.000 feet we know we can't guarantee sufficient instrument accuracy to insure adequate traffic separation. We know that the instrument lag in a high speed descent is totally inconsistent with the precision we require of a jet letdown. Plus the fact that what accuracy we do have depends on continual checking by radio with ground stations to get the altimeter setting and then calibrating for temperature and instrument error. Unless the pilot can check every 50 miles or so he can never really know his true altitude. And even when he does, he only knows his altitude above mean sea level. To know how high he is above the ground, 'e 'as to do sums in 'is 'ead again.

- *Fuel.* How vital can we get? This is one thing Joe Pilot must know with certainty at all times—how much fuel does he have? Admittedly, we have made some progress since the B-24, whose fuel gages were back in the radio compartment and could really only tell you if there was or was not fuel in the main tanks. Even so, look at the can of worms we have. In some of our airplanes the bouncing pointers show gallons—in all or in individual tanks. In others the pointers show tenths of capacity (more arithmetic?). In others we see pounds of fuel. In our jets the clicking counter shows our fuel being used up—*if* it was set right to start with. Fuel mismanagement—how we love to use that word—how much of it is traceable to fuel systems and indicators that just don't lend themselves to being managed properly?

- *Warning lights.* The pilot of a jet fighter has a lot of things to worry about and precious little time to waste worrying. The concept of a warning light instead of an instrument is generally sound. It's something you don't have to watch all the time, but it sure lets you know when something is wrong. It's a good enough idea as long as it isn't run into the ground. A few clearly identifiable and readily understandable warning lights serve a useful purpose, but when we allow a cockpit to be rigged like a pinball machine, this way lies madness. The right side of the panel in the F-84F sports a magnificent display of lights—each one tersely labeled, the bottom one being clearly identified as "Emergency." (Sic) Presumably when all light at once you have hit the jackpot and you may leave at will. Seriously, considering that each one of these lights involves emergency action in connection with one or other of the aircraft systems, and that a light coming on calls for immediate identification of the system involved, diagnosis of the trouble and proper corrective action, this type of presentation of data asks a lot of Joe Pilot. The point is—in evaluating the desirability of a warning light we must realize that it's a panicky kind of gadget, rather like a siren. It doesn't tell you what's wrong—it just hollers that something is wrong. It alerts a pilot—or panics him—but it doesn't give him a bit of information.

Now that we have made a big issue of all this, where do the working troops fit into the picture? Isn't this just a manufacturers' kettle of fish? I don't like to think so because all of us have to fly these airplanes, use this equipment, to do our job. If the equipment is poorly adapted to the job, are we entirely free of blame? We may each have a specifically assigned job, but we are not compartmentalized when it comes to our responsibility to the Air Force. In the procurement of aircraft and associated equipment a lot of factors have to be taken into account, and unless the pilot's beefs are documented they stand a good chance of being overlooked. Systems such as the UR program, the Product Improvement Program, are set up to register just such beefs. So if the user doesn't want to see shortcomings perpetuated, he would do well to get his head out of the bucket and let his voice be heard. A lot of lives could be saved if we wrote more URs and groused less.

The other very important aspect of this for the people on the line: Get really acquainted with the booby traps in your aircraft and procedures. Until they can be corrected or eliminated, you and your fellow pilots will have to live with them. Forewarned is forearmed. No one likes to be a patsy for a sucker play—so know the pitfalls and be prepared for them. Finally, if somebody does trip up, be alert to spot the real cause and let it be known. If it's fuel mismanagement, don't just leave it at that—trace why the system was mismanaged. Even if you conclude that the pilot was an idiot, don't drop the whole thing until you've given some thought to whether a system could not be made idiot-proof. After all, there'll be more idiots coming along. Consider the feasibility of incorporating what the Navy likes to call a "Dilbert factor" into our equipment and procedures. There'll be many a Dilbert flying our planes before the last trumpet sounds. How about giving Dilbert a break? ●

Well Done

First Lieutenant

Donald C. Hanto

91st F-B Sq, 81st F-B Wg.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★

1ST LT. DONALD C. HANTO was headed home after having gear trouble on a practice bombing mission. Letting his F-84F down at about 320 knots, he called the tower for landing instructions.

While descending through 5000 feet, the engine flamed out. A quick check of the cockpit showed everything was "normal." Lt. Hanto informed the tower of his flameout and was cleared for a straight-in approach to runway 26. He tried a series of airstarts, without results, so he concentrated on the flameout pattern.

Realizing that he was too close for a straight-in approach to runway 26, Lt. Hanto pulled up immediately to 7000 feet and set up optimum glide speed. From this position he could establish a downwind leg for a landing on runway 08. The turn onto final approach was completed at 2000 feet, approximately one and a-half miles out at an airspeed of 260 knots.

He slowed to 230 knots and shoved the gear handle down. The main gear went down and locked, but the nose gear indicated unsafe. Speed brakes and flaps were extended and the approach continued. Lt. Hanto waited until he knew he had the runway made and then went to work on the emergency system. The nose gear snapped down and locked, and he crossed the end of the runway at 175 knots. During the roll, he used the brakes to the maximum while engine RPM was available to provide boosted brakes. The right tire blew but he maintained directional control and stopped short of the barrier.

Inspection showed that the flameout occurred when the throttle linkage became disconnected from the fuel control.

Lt. Hanto's cool reaction to an emergency situation and the professional skill he demonstrated qualifies him for a hearty "Well Done."

T-37

"Knee-high to a...."

Bob Hagan, Cessna Aircraft Company

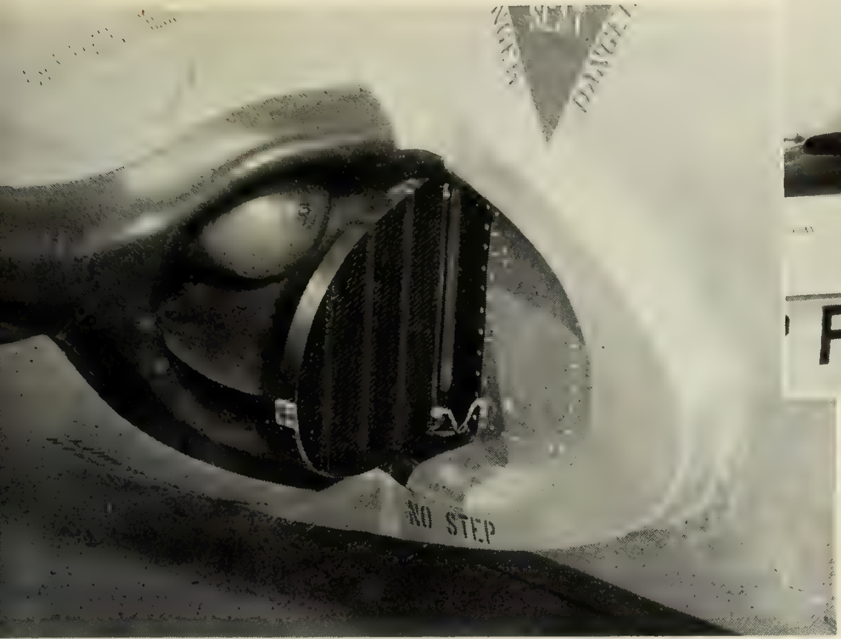
This article, prepared by a veteran test pilot, introduces the T-37. Only 29 feet long and with a wing span of about 34 feet, it is scheduled to appear on the air training scene.

FOR THOSE OF you who have not seen or heard too much about the T-37A, it is a twin-engine, side-by-side jet trainer. When you have your first look at a T-37A, the small, neat appearance will probably impress you greatly since the airplane is a friendly looking little rascal and is only about knee high to a "short" Texan.

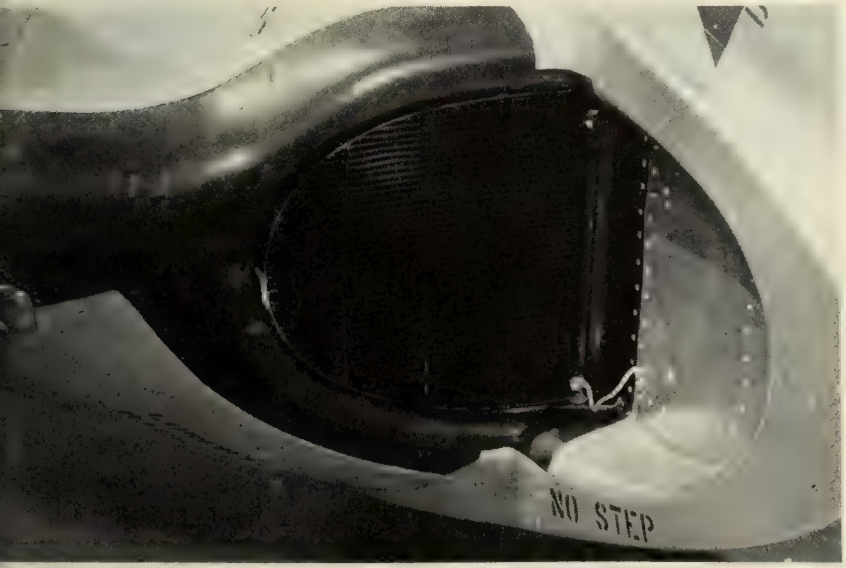
A fast look at the dimensional statistics shows the overall length at about 29 feet and the wing span approximately 34 feet. When you consider the distance from the ground to the top of the vertical stabilizer is only nine feet, you can see that this aircraft falls into the small bird category. Once you fly the T-37A, however, you will forget about its size because this airplane has everything its big brothers have in the way of

The "knee-high" T-37 has good flying qualities.

A stall spoiler generates natural stall warning.



Screens cover the intakes when the wheels are down. They retract automatically with "gear up."



flying qualities and maybe just a little bit more.

The airplane carries two centrifugal flow, Continental J-69-T-9 engines, rated at 920 pounds of thrust. The intakes are in the wing roots and they are covered by retractable screens to reduce foreign object damage. The screens are operated hydraulically and cover the intakes automatically when the gear is down.

As this article is being written, the only flight test item of any consequence that isn't completed is the structural integrity investigation. As a result, the "G" limit is plus 5.0 and minus 1.9G until the structural tests have been completed.

All of the other major flight test programs including the spins have been completed. After finishing one of the most comprehensive spin programs ever accomplished on an airplane we can safely say that any type of spin or spin entry is permissible in the T-37A. Also, any normal acrobatic maneuver is permissible.

Before we go fly, let's make a walk-around inspection and cockpit check. As we approach the airplane you will note that this is one bird that meets you on your own level. The walk-around covers nothing unusual. During the inspection, note that just one built-in step (per side) is used for ingress and egress. The step is just forward of the engine inlet boundary layer dam.

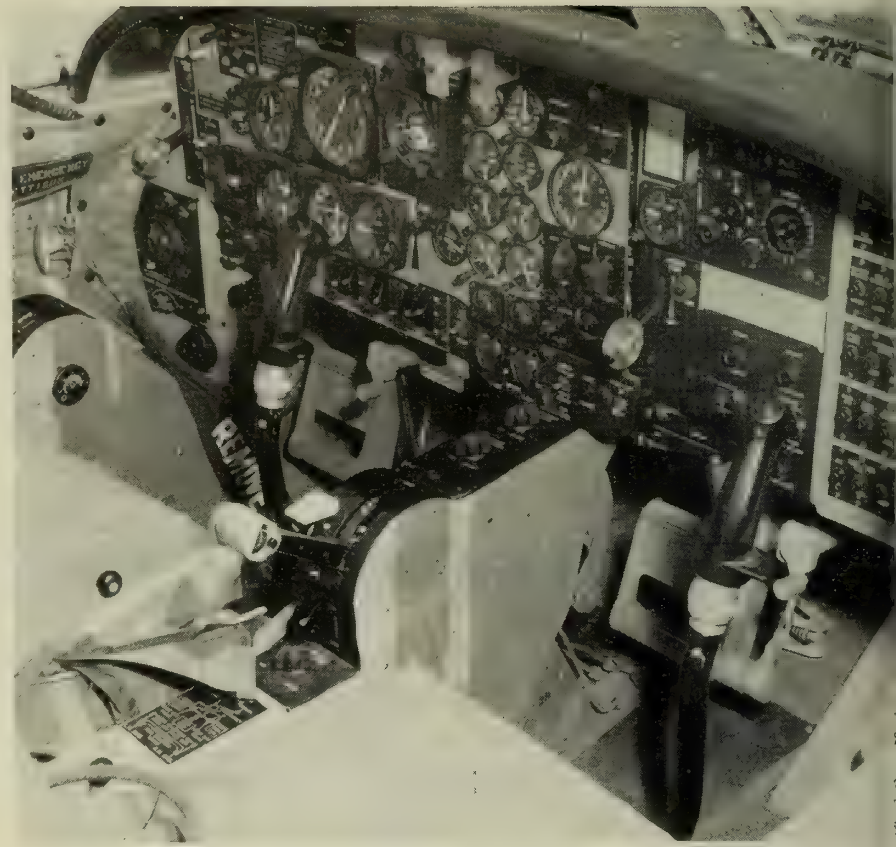
Since the T-37A has a side-by-side seating arrangement for the student and instructor, the cockpit layout is a little different than the average airplane. It has dual controls for all flight and power controls plus dual landing gear and flap controls. The instruments are arranged so that the student pilot (on the left side) has the standard instruments in front of him, plus the engine starting switches. The engine instruments and fuel shut off switches are in the center of the instrument panel so both the student and instructor can monitor them. On the instructor's side is the radio panel (both communications and OMNI) within reach of the student. Also cockpit heat, defrost and ventilation controls, circuit breaker panel and instructor's oxygen control panel are located here. So the instructor knows when to brace himself or close his eyes, an airspeed, altimeter and turn-and-bank instrument are installed on his side of the cockpit.

There are three safety pins for the student to pull before takeoff and one for the instructor. Two of the pins which the student pulls are for the canopy jettison, and one is for the ejection seat. The instructor's pin is for his ejection seat. All of the pins are stowed in a pocket on the left wall of the cockpit. The canopy and seat ejection are similar to the majority of the ejection systems in use and need no explanation here.

After adjusting the seat and rudder pedals (adjust fore and aft with a crank) let's begin the cockpit check. With the APU plugged in and running or the battery switch turned on, this check consists of checking the position of throttles, gear and flap handles, oxygen control panel, pertinent switches and the push to test lights on the student's side of the cockpit. On the instructor's side, all circuit breakers should be in, and the radio and heat control turned off. The cockpit check is so simple that a step-by-step run-down is unnecessary here.

About now we should be ready to start the engines. Since the T-37A starts just as well on the battery as it does with an APU, let's use the battery for starting. The procedure goes like this:

- Turn on battery, inverter and fuel pump.
- Open fuel shut-off valve for left engine (push left "T" handle above engine instruments).
- Push up on starter switch and hold.
- At five per cent rpm push up on ignition switch and hold.
- Bring throttle forward to idle.
- Release ignition switch at 16 per cent and starter switch at 22 per cent rpm. Engine will idle at 33 to 34 per cent.


The T-37 has dual flight and power controls and the student's side has the standard instruments.

To start right engine, run the left engine up to 15 to 50 per cent rpm to allow the generator to furnish the power and go through the same procedure as for the left engine.

The switch to close the canopy is just aft of and below the throttles on the instructor's quadrant. As a safety measure, be sure to lock the canopy any time it is fully closed for taxiing; the canopy light will go out when the canopy is properly locked. If taxi instructions have been received, "rev" up the engines a bit, push and hold the fourth finger button on the control stick for power steering and proceed to the active runway. Engine rpm for taxi is 45 to 50 per cent.

Since there is a hot mike in the airplane, the instructor can be talking to you from "electrical power on" until the engines are shut down.

Prior to moving onto the *active*, take a look at your checklist to make sure nothing has been forgotten.

Takeoff may be made with or without nosewheel steering and with or without 50 per cent flaps. Takeoff in the T-37A is the same as in any other jet, with one major exception. After upping the rpm to 100 per cent on both engines and checking the instruments, release the brakes and go! The difference between the T-37A's takeoff and other jets is soon apparent. You are airborne about 1200 to 1500 feet down the runway at about 80 knots airspeed. After retracting the gear, pull the flaps up and climb on out. When the flaps are raised from takeoff setting (50 per cent), there is very little sink to the airplane, so there is no need to milk the flaps up after the takeoff.

During the climb, notice how light the controls are even though they are

★

The Author

Bob Hagan flew 91 combat missions in World War II in P-47s with the 9th Air Force. During the Korean conflict, he participated in the first hydrogen bomb test, flying F-84s for the Strategic Air Command. He joined Cessna in 1953 and flew the XT-37 on its first flight in October, 1954.

Note starting unit receptacle. The T-37 measures nine feet to top of stabilizer.

unboosted. The ailerons have a good, light feel to them from stall to about 250 knots. Above 250 knots the forces get heavier but the ailerons are still very effective.

In order to get the feel of the airplane, a few stalls in the different configurations and some acrobatics should help you get acquainted. With everything down, with or without power, the stall speed is 60 to 65 knots and is a normal, straight forward stall. Clean, the plane stalls out about 75 to 80 knots. Adequate stall warning is available in all configurations, and consists of buffet in the stick and airframe. With flaps down and 65 per cent or more rpm, take a look over your shoulder at the stall spoiler on the engine nacelle. The spoiler generates natural stall warning when the flaps are down more than 60 per cent and the engine rpm is greater than 65 per cent. When the stall is completed, just release the back pressure on the stick and the recovery is made. You might notice that the ailerons are effective all the way through the actual stall.

Shown here is the '37 in flight. Notice the extended speed brake in above photograph.

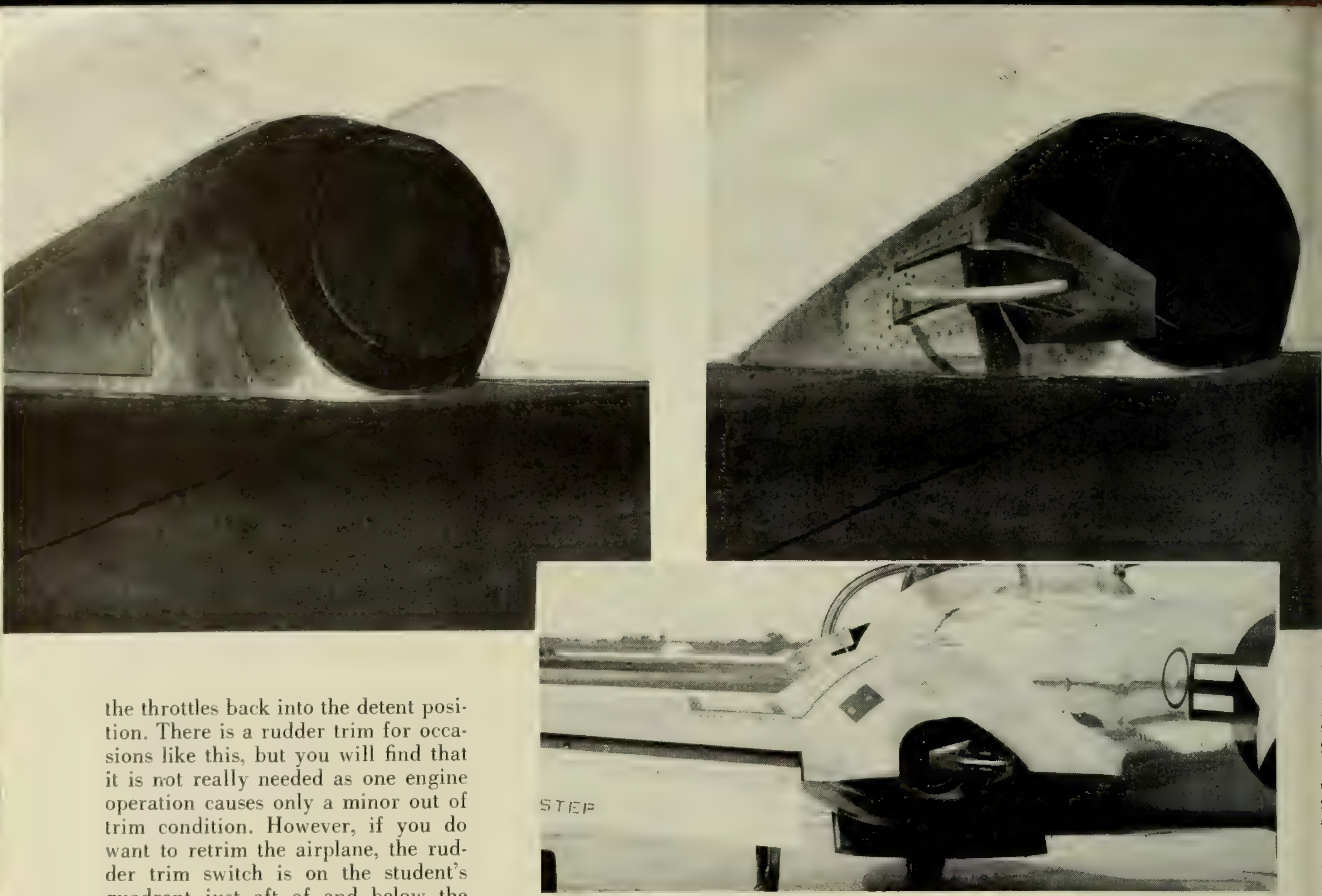
Rolls may be done over a wide range of airspeeds, 130 knots still will allow a good solid feeling roll at the low end and there is no restriction on the high speed end. For a trainer the roll rate is very fast, 120 degrees per second may be attained at cruise speed.

For loops, Immelmans and Cuban eights, 250 knots is a good entry speed for the first few; after a little practice the entry speed may be lowered. Any of the above maneuvers may be done without pulling more than 3G and within 2000 feet at practically any altitude. Loops have been done with an entry altitude of 25,000 feet. Since you are sitting off to one side of the airplane centerline you may need a little practice to be able to roll out straight at the completion of an Immelman, but that will come very quickly.

The spin program was mentioned earlier in the article, so a few words about the spin are in order. During the walk-around inspection you should have noticed what looks like the spray dampener used by boats and seaplanes on both sides of the airplane nose. Actually we call them "strakes" which is a Naval term. Instead of dampening spray, however, our "spin strakes" dampen the flow of air around the nose of the airplane in a spin and as a result we get a slower and steadier spin. From almost any type entry with idle power, the spin is steady in one-and-a-half to two turns with the time for each turn taking approximately three seconds. Recovery is made in the standard manner by applying opposite rudder and waiting one-half turn before popping the stick forward to about one-half down elevator. Recovery will be complete by one-and-a-quarter turns. The spins are covered in the flight handbook so not too much will be said about them here. However, I believe you will like the spins in the T-37A, if you happen to like spinning at all.

For high speed restrictions the critical Mach needle is set at .7 Mach. The airplane has no change in characteristics up to .7 Mach. However, if you happen to get your airspeed needle past the critical Mach indicator you will get a stick force reversal at .75 Mach accompanied by airframe buffet. When this occurs, pull the stick back to keep the same airplane attitude toward the ground, open the speed brake and reduce power to idle. The airplane will pull out by itself if you'll just hold up elevator to keep the nose in the dive attitude you had before reaching the .75 Mach area.

On the way back to the field for landing you may want to try a single engine flight. If so, just pull one of



Close-ups of the tailpipe area show how the thrust attenuators appear; extended and retracted.

the throttles back into the detent position. There is a rudder trim for occasions like this, but you will find that it is not really needed as one engine operation causes only a minor out of trim condition. However, if you do want to retrim the airplane, the rudder trim switch is on the student's quadrant just aft of and below the throttles. Stalls and turns into or away from the dead engine are easily accomplished. So single engine operation including landings is actually "no sweat" at all.

Before starting the engine again, be sure to drain the tailpipe and then if the windmilling rpm is eight per cent or more, depress the starter switch to the airstart position and hold for three seconds. Then, when a little action is shown on the EGT gage, bring the throttle up to idle. If the windmilling rpm is eight per cent or less, use the regular ground-start procedure. Either way the airstart is simple and fast.

Before we go in to land, a word on the endurance capabilities of the airplane may be in order. The total usable fuel load is 309 gallons of JP-4. This will give you a maximum endurance of approximately three hours, if you climb directly to 35,000 feet and stay there. For normal runs where the altitude varies between the ground and 20,000 feet, an hour and a half missions are well within the capabilities of the T-37A.

For landing, the checklist is short and sweet. It amounts to checking the instruments, the hydraulic pressure and making sure the fuel boost pump is "on" (it stays on all of the time, anyway). A good initial speed is 180 to 220 knots, speed brake down at the break, and engine rpm retarded to 50 to 60 per cent. Gear down at 150 knots, flaps full down at 135 knots, base leg should be made at 110 to 120 knots with about 105 to 110 knots for final. Over the fence at 95 to 100 knots and reduce power to idle when landing is assured.

After touchdown at 75 to 80 knots, the brakes may be applied as soon as you need them. Notice how easy it is to judge the flare and landing. I believe this is caused by the fact that your eye level on landing is approximately the same as it is if you were standing on the runway. The landing can be made in less than 1000 feet without too much strain.

Pull the speed brake in as soon as the turn is made off the runway. This will retract the "thrust attenuators" (that's a fancy Cessna phrase meaning thrust destroyer).

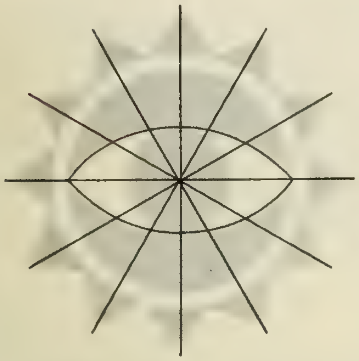
Actually, the attenuators are metal paddles streamlined into the fairings aft of each engine nacelle. Their purpose is to cut down the engine thrust on final approach so that 50 to 60 per cent rpm may be maintained, for rapid engine acceleration if needed, and still allow a fairly steep approach angle. They extend only when the speedbrake is out and the engine rpm is below 65 per cent. In case of a go-around, they retract automatically when either the speed brake is retracted or the power is advanced beyond 65 per cent.

Crosswind landings and takeoffs present no problem. Believe me, I speak from experience since all of our test work has been done in Kansas where the wind always is blowing.

In this short article I have tried to give only a few basic tips on the T-37A. When you fly it you'll probably learn more about the airplane in one flight than you could from reading this article or talking to anyone.

I'm sure you will agree with me after you fly it that it is a simple airplane to master and the friendliest one you've ever been in. I hope that you enjoy flying it as much as I do. ●

LOOK SHARP



Capt. John F. Welch, FSO, 77th Bomb. Sq, Ellsworth AFB.

IT WAS A hot day in Oklahoma, but a hot day is a good day to put up hay and so the two farmers, Hank and Pete, were hard at it.

Pete drove the tractor while Hank hooked the bales and dragged them on to the low trailer as it went by.

Hank held up his hand as a signal to stop.

"Shut 'er down, Pete, it's time for a shot of water," he said, mopping his brow.

With the tractor exhaust silenced, the low frequency throb of distant propellers could be heard.

"Sounds like one o' them B-36s," drawled Pete. "They're usually pretty high. Wonder if we'll be able to see 'em?" He tilted the water jug up for a mouthful, rinsed his mouth and spat, then took a long drink.

Hank was scanning the sky. "Yeah, there she is, comin' in from the southeast, Fort Worth, prob'ly."

Pete was looking now, while Hank had a drink.

"Hey!" he exclaimed. "There's another'n, comin' over from the west."

"I was readin' in the paper the other night that those things cost three an' a half to four million dollars apiece," mused Hank. "Look, they're gonna come pretty close to each other. Look about the same height, too."

"Yep," replied Pete, "They must be about five miles up. Wonder if those fellas wave at each other when they meet?"

"Man, they're gonna come awful close! Oh, Lord! They smacked inta each other head on!"

Hank and Pete stared unbelievingly at the flash of fire and smoke in the clear, blue sky above them. The tangled mass of wreckage began plummeting toward the earth, with some of the pieces floating off separately.

Pete ran for the tractor. "Hank, you watch for parachutes, and I'll run and call the Sheriff or the Highway Patrol or somebody."

As the tractor roared away, there came the sound of the distant explosion of the two meeting aircraft. Hank slowly shook his head. "Pete," he said to himself, "I don't think there'll be any parachutes."

The above incident hasn't really happened. But it has come closer than some B-36 crewmembers like to think about. And accidents like it *have* happened in other types of aircraft.

When you're tooling along in actual weather, you can depend on ARTC for separation on airways. But when the sky is clear, look out. The quadrantal altitude system is a big help, when it is followed. At least you sneak up on another airplane or get sneaked up on by one, a little more slowly, and there's more time to see or be seen.

Unfortunately, both for themselves and for people who are following the rules, too many aircrews tend to pick an altitude and maintain it throughout a flight, regardless of heading. This is partly because ARTC clears flights to cross airways at a particular thousand foot level. And it's partly because a change of altitude changes the navigator's and flight engineer's problems, causing them complications such as new problems to solve, and more log entries.

For some reason, aircrews seem to prefer nice, round numbers — like 5000, 10,000, 20,000 or 30,000. Ask any ARTC center or RBS site. You'd almost think that the altitudes in between are uninhabitable. With traffic piling up at the round number altitudes, they're becoming the uninhabitable ones.

Some Air Force pilots are probably unaware that altitudes above 20,000 are no longer the private preserve of the military. Transcontinental airline flights in DC-7s regularly use 23,000. As the airlines and some business planes change over to turboprops and to jets, they'll go right on up. From now on, you'll have to be looking out for them, too.

In any case, the little extra work saved by neglecting to change altitude once in a while isn't worth the risk. So, fly the proper altitude for your heading. Your chances of seeing another aircraft approaching from a quartering or head-on direction, even a lumbering C-124 or a B-36, are very small.

Two B-36s at 25,000 approaching each other head on would close at a rate requiring less than eight seconds per mile. Think what it is in jets! (See "Short Seconds," FLYING SAFETY, August 1954.)

The problems discussed here apply to VFR flight, when you have some hope of seeing another aircraft. Now here's something applicable to IFR that some Air Force pilots do not know about. When you are on a block altitude clearance, IFR, either in a bomber stream or on an individual clearance, ARTC is *not* responsible for your separation from other aircraft in the block. *You* are. The author once monitored such a mission from an ARTC Center. Two aircraft in the block clearance reported IFR over the same point at the same altitude, two minutes apart. That's not good. And they could not even be warned about how close they were, because immediately after reporting, both apparently changed frequencies.

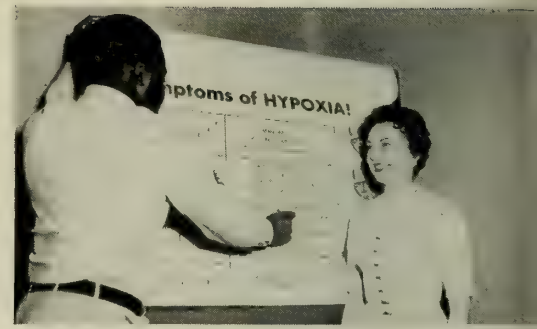
Experience has shown that most collisions and near misses occur under good visibility conditions. The problem is most acute in congested terminal areas. When you approach your landing base or fly into or through an area containing one or more airfields, it is wise to monitor other traffic closely. Try to pick an altitude no one else is using. For VFR flight at night, the flashing beacons used by commercial aircraft (and now being installed on Air Force aircraft) are a big help. If possible, all crewmembers, including pilots, should always be on the lookout for other aircraft in congested areas at night and in the daytime, too.

Air Force, Navy, Army, the airlines, CAA and ICAO are all aware of the collision hazards induced by increasing traffic and a wide diversity of aircraft. The Air Coordinating Committee is working on revisions to flight rules that will reduce these hazards. Meanwhile, it's up to the aircrews to make it a point to look sharp (for other aircraft) and fly sharp (at proper altitudes). ●

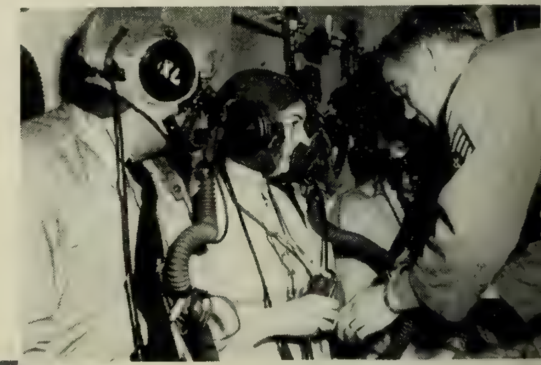
The attitude of the "little woman" toward flying is very important to you, whether you admit it or not. So here is a reassuring . . . .

Word For Your Bride

DelVina Wheeldon


ptoms of HYPOXIA!

Important lectures on hypoxia were received.



The pressure chamber resembled an incubator.

HOW DOES IT feel to be the first woman passenger to go through the sonic barrier?

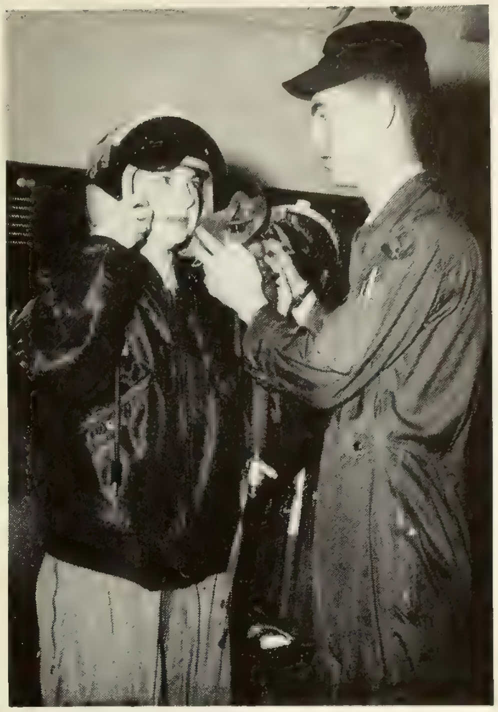
Ever since I went 830 mph in a dive from 48,000 down to 18,000 feet over the Great Lakes on May 12, 1956—the day before Mother's Day—people ask me this.

And it gives me the opportunity to tell them why I did it, which is a great deal more important than they have thought. It puts the whole thing in a new light.

Since I am a woman broadcaster, there naturally was some suspicion that this was done just as a publicity stunt. But neither my station nor I had any such idea when I wrote to the Continental Air Defense Command last March. My letter said in part:

"Not long ago, I heard some women talking about why they did not want their men to be in the Air Force. They said that jets were dangerous and did not want their sons or husbands flying them or near them. It seems to me with all the responsibilities the Air Force has for our national protection that it should not have to suffer unnecessarily 'mother antipathy' toward

Getting set for a fast ride, straight up.



Fitting of personal equipment had to be done before I was ready to climb into the F-94. I was briefed on all emergency procedures.

jet flying while meeting those bigger responsibilities."

My letter further told them that my conversations had shown that women know appallingly little about the Air Force, all of its safety factors in flying, what it's like to be in it, what its problems are and why it has to do what it does. For this reason, I stated my desire to do at least 13 and possibly 26 broadcasts interpreting airpower subjects in terms a woman could understand.

In this letter I threw in my best hope, asking if I could be given a jet ride and to approach or go through the sonic barrier. If this is done by a woman who is a housewife, I don't see how other women can fail to see their fears are groundless.

My purpose was to be able to talk woman-to-woman about it, and to do it with authority gained by actual experience.

If it is possible to find an over-the-back fence relationship between women and airpower, it seemed to me that the pass-word should be the air defense system. Air Defense units must not only live in close proximity to populated areas but must be prepared to scramble to altitudes and, if war comes, fight over the heads of all of our citizens.

There was a period of quiet which I, at first, charged to bureaucracy, but later found that the time was being used far differently. I was being listened to on the air, checked for sincerity and my program content, and only after I had passed the test did the gate swing open. It was then I found out that this Air Force is a very serious, demanding business—that it takes and leaves nothing to chance.

The first step was that I have a complete physical examination. My doctor's statement of my health's excellence, he said, "referred to the physical, not the mental." He had serious doubts about the latter. When over that hurdle. I was taken to Wright-Patterson Air Force Base near Dayton, Ohio, "the birthplace of aviation." It was my thought that after they put me through the long lectures on atmosphere, air pressure, hypoxia, use of bailout bottles, ejection seats, and then finally into the pressure chamber, that I was going back into the incubator.

As Captain Thomas Mowry, the boss of the pressure chamber, took us up to 43,000 feet (in air density equivalent), I had my tape recorder spliced into the communications system to get his talk and my questions on record. To show me what hypoxia was like, and how to recognize it they took me off oxygen at the 30,000-foot level. I had to start putting pegs in a block which reminded me of an oversize cribbage board. There was a round peg and a square one to match the holes in the block. The object was to see how long I could do a real simple job correctly without a normal amount of oxygen. It took me a minute and ten seconds before my eyes went fuzzy, my hands and arms froze in place and a dizziness crept up on me.

After a quick whiff of oxygen, I came back real fast and started putting the pegs in the right holes without knowing that I had ever stopped. I made note on the tape of the hypoxia peculiarity which saves lives with oxygen restoration—the tendency of the individual to resume automatically what he was doing—a considerable reassurance in itself.

The rest of my days at Wright-Patterson were spent in talking to key Air Defense people, to our Air Force recruiters and to Air Force wives. I wanted to find out how it is to live and raise children in such a migratory existence. The answers were all informative, positive and constructive, and I was growing prouder by the minute of the Air Force and my association with it.

Then, the last day of my stay, 1st Lt. Robert Kline, a 26-year-old, F-94C pilot from Bunker Hill Air Force Base, Peru, Indiana, came sizzling in. He was the man to take me for my crowning experience: the jet ride and the assault on the sonic barrier.

He was originally from Indiana, Pennsylvania, he said, and reminded me that this was also Jimmy Stewart's hometown. "He makes movies," he said with a big boyish smile.

Although I was once a Powers model, the fashions I now found myself in were a far cry from the svelte materials and designs I once wore. Even for this, Kline had counsel. As I donned my bulky, flight gear, Lt. Kline remarked: "We don't make you pretty, but we try to keep you safe." He then explained the cockpit procedures several times and made me go through the rituals until I knew them by heart.

The Wright-Patterson tower had its bit of fun with me when Lt. Kline said he was going up with a lady aboard. The tower asked if he was flying or if I was the pilot.

In an air of authenticity, we went all the way through the Air Defense scramble procedure, from the squawker going off, the alert hangar doors swinging up, to the engine start and the scamper for the runway, and then the takeoff.

Almost before I knew it, I was hearing the pilot report us at 20,000 feet, still climbing, and with Lake Erie almost in sight. We were going far out over the lake where the sonic blast would not bother anyone.

"Leveling off at 48,000," Lt. Kline reported. "Ready?" Then he said, "Here we go." Despite all my thoughts at the time, I still remember that he settled me down with his quiet tone. It was as if he had said to a taxi driver that we would turn at the next block.

Could this be the thing I had heard those women worrying about in the beauty shop last week.

I watched the indicator as he had told me to do, saw the needle cross the line showing Mach 1 (the speed of sound), and I felt a shiver pass through the plane. That's all there was to it. Was I surprised.

Could this be the thing I had heard those women worrying about in the beauty shop? What was there about this, I asked myself, that should cause anyone to fear the experience?

The Air Force had put more than $70,000 worth of training into Lt. Kline before they had ever let him go it alone at those controls. Then I remembered the women I knew who had given way under pouts, pestering and other domestic persuasion to their kids, letting them slide behind the wheel of the family car with no experience whatever and thought them safe. It didn't make sense to me.

"We hit 830 miles per hour," Lt. Kline said later. Imagine 830 miles an hour! And I felt safer doing it than I ever felt driving on the highway or in my own neighborhood with all the kids out in hot rods.

My pilot's tone of voice had never changed (if you are a broadcaster you notice things like that). He loved flying—that I knew. He was in control of his own destiny—that he made me feel. And his job was to be ready to fight in order to keep the peace—which now dawned on me for the first time.

Some of this, I hope to get across to other women. When we landed, I was given a certificate of my accomplishment. A few days later, there was a wire from the Aircraft Industries Association which declared me to be "the first woman passenger to go faster than the speed of sound but only one of many who would have the experience in the future as supersonic flight becomes normal as aviation progress marches on."

But the thing which made me feel good inside that night was when I heard another broadcasting colleague on an opposition station telling of my thrilling experience.

"And our DelVina," he said, with his eye on the day after my feat, "provided the most unique Mother's Day present of all when she rode this Air Force jet faster than the speed of sound. Her Mother's Day present was one of reassurance." ●

Cool, Clear Water

If there is any one essential to staying alive, it's water. But leave a thin coating of it on the wings of an aircraft, take off in freezing temperatures, and the role of water, the life-saver, takes a one-eighty.

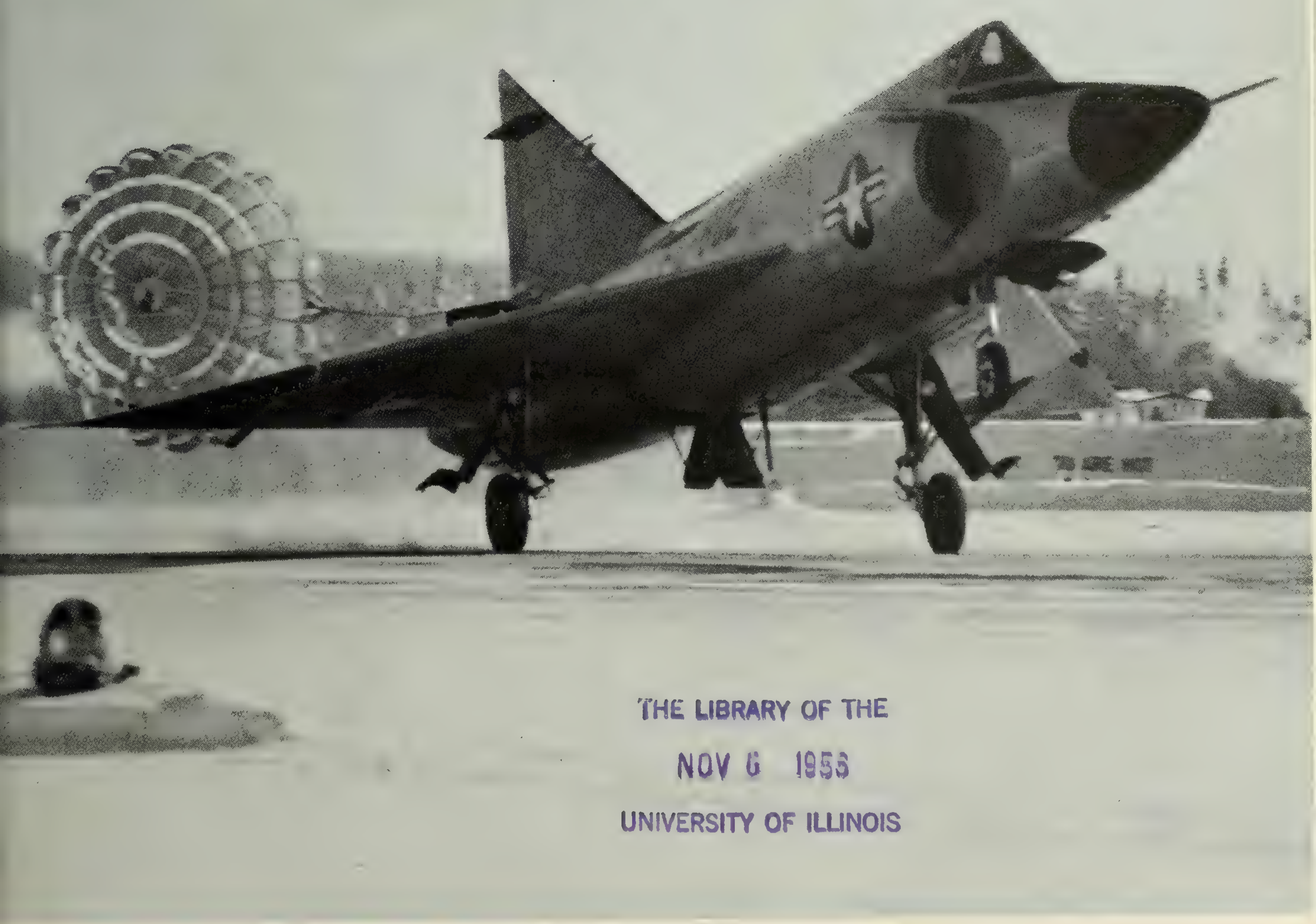
U. S. GOVERNMENT PRINTING OFFICE . . . 326338

9.1305
LYS

FLYING SAFETY

UNITED STATES AIR FORCE

OCTOBER
1956



THE LIBRARY OF THE
NOV 6 1956
UNIVERSITY OF ILLINOIS

The 102 Below Zero • "Casey" Goes Jet

File Thirteen

This month our cover illustrates the F-102 winter tests. The Air Force will soon be operating this bird where it gets mighty cold. . . . An interesting item hit your editor's desk concerning fire equipment at P and PC fields used, on occasion, by Air Force types. Civil fields have no minimum fire protection or aircraft rescue standards. Keep this in mind before clearing to such places or selecting one for an emergency landing. . . . While on the subject of civil fields, check to be sure you do not get a charge of medicinal oxygen in your flying machine. It contains an unsuitable amount of water vapor that may freeze at the higher altitudes. . . . A recent message reiterates the requirement to have runway markers indicating *distance remaining*. The signs should read the same on both sides of the strip. Remember to subtract your computed takeoff roll from the runway length to come up with the marker figure needed. On a 10,000-foot runway and a computed roll of 6000 feet, you should break ground around the 4000-foot sign. . . . The new 60-16 allows a pilot, with his own clearing authority, to clear other aircraft under his control on IFR flights. Amid wails of "no pilot should ever be permitted to clear other than his own aircraft IFR," think about it for a minute. The requirements for obtaining your own clearing authority are more rigid than those required for AO duty, with delegated clearing authority. As such, it seems to me that a flight leader, with his own clearing authority, is much more qualified to clear his flight IFR than possibly a 1000-hour airdrome officer. . . . The yearly subscription to FLYING SAFETY has been reduced to $2.50 (domestic), $3.50 (foreign). Be my guest and send your check to the Government Printing Office.

'til next month,

Perry J. Dahl

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major V. R. Stutts

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby
T/Sgt. Chester McCubbin
T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune
A/1C Al Fagerwick
T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

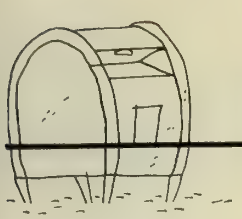
Weather or Not 2
Well Done 7
The 102 . . . Below Zero 8
Keep Current 14
Know Thyself 16
The Saga of G's George 20
Casey Goes Jet 22
The "Down to Earth" Approach . . . 26

VOLUME TWELVE NUMBER TEN

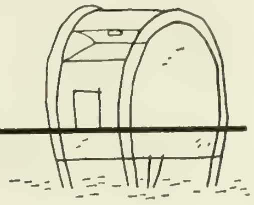
SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1



LETTERS TO THE EDITOR



More on Wind Shear

The article, "Change Without Notice" by Major Neyland (FLYING SAFETY, April 1956), interested me particularly because of an F-86 undershoot accident which I investigated last year. Just as I began the investigation, I was fortunate enough to read the ADC "Archie Newsflash" which discussed wind shear.

The accident in question brought to light a particularly dangerous type of wind shear. Touchdown was more than one thousand feet north of a north-south runway. The runway slopes uphill from south to north. The terrain for the first few thousand feet north of the runway is substantially lower than the north end of the runway. A south wind was blowing up the runway.

When the south wind reached the end of the runway it was being pushed upwards by the slope of the runway. The wind passing over the low ground north of the approach end of the runway caused a low pressure area which set up the same kind of eddy currents as form downwind of buildings or mountains. The wind flowing into the low ground had both downward and northerly components. A pilot landing to the south who got into the eddy current north of the approach end of the runway would suddenly have a tailwind instead of a headwind.

The pilot thought he was right in the groove as he flew his pattern into the wind announced by the tower. At some point in his final approach the headwind was replaced by a tailwind, caused by the circulation of wind into the low ground north of the approach end of the runway. The airplane which had been flying 15 knots above stall was instantaneously 20 or more knots below stall speed. Before airspeed could be regained the airplane sank to the ground.

This is a good time to try to get across the point that landing 1200 feet short of the runway in a swept-wing aircraft is not necessarily an indication of gross pilot incompetence. If an aircraft is coming in with a glide angle as low as 12 to one, a difference of 100 feet in altitude will mean a difference of 1200 feet in the length of the glide. Wind shear can mean a loss of more than 100 feet in altitude before the pilot can regain flying speed.

Landing techniques developed in the days of conventional aircraft, which are quick to regain lift upon application of power, are responsible for our rash of undershoot and overshoot accidents. Many a pilot of a swept-wing jet has been condemned with a "pilot error" accident, when the real responsibility lies with instructors and supervisors who are—unconsciously—thinking in terms of practice deadstick landings in the PT-17 type aircraft.

Col. Robert C. Brown
AF Sr Adviser, ANG
128D FIW, Louisville, Ky.

Yes, this quirk of Mother Nature and the slow acceleration rate of jet engines can cause havoc. Thank you for your interesting observations.

★ ★ ★

Help Wanted

Reference is made to the article "Riser Sharp" in your May issue.

The type of quick release described is excellent when the person involved in its use is not injured. I had several pilots wounded in one arm or the other, also through shock or loss of blood, not able to work the two releases, which are, at best, in an unnatural position to reach. Ejection bailout of a jet from an unusual position, high G forces or the like, often result in hand or arm injury which again presents difficulties in using this type of quick release. I strongly urge that consideration be given to a quick release mechanism which can be worked with one hand, requiring little force and located in a position that can more readily be seen or felt.

I have previously UR'd this type of quick release and each time received the reply: "If the chute had been properly fitted, no difficulty would have been encountered." This is in error and I solicit comment and support to gain for all personnel involved a better type of quick release.

Col. Harrison R. Thyng
Vice Comdr, 9th AD (Def)
Geiger Fld, Washington

Nice to hear from the main character in our episode "T-Bird in a Tempest" (FLYING SAFETY, July 1955). Your letter and recommendation have been sent to the Aero Med folks. Anybody else care to comment?

★ ★ ★

Intake Hazard

A recent incident at one of our bases revealed that an F-86A intake dust cover can get lost in the throat of the intake duct. Fortunately, this did not develop into a catastrophe. It could, however, and it might. Tests revealed that a strong gust of wind or a jet blast will dislodge the intake dust cover. Several crew chiefs have stated that they found the dust cover lodged under the cover assembly, engine accessory section.

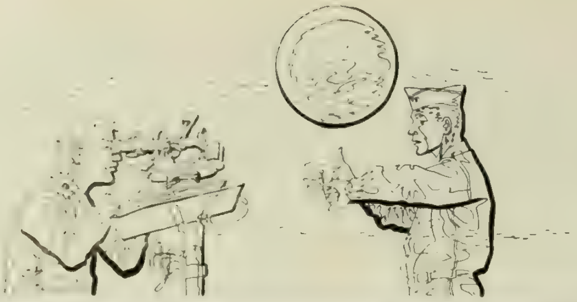
Here's the fix on this problem:

- Paint dust covers with a luminous white paint.
- Attach a long red piece of webbing to the dust cover handle and loop it over the cockpit access handle.
- Have crew chiefs carefully inspect intake chambers and write with white chalk the date of inspection on the front of the cover assembly, engine accessory section.

If the above action is taken, it might not preclude flying the "bent-wing" with foreign objects in the intake but a fellow will have to work to do so.

Capt. Paul L. Smith
Director of Flying Safety
Hqs Fourth Air Force

Kudos to all crewmembers for such an excellent fix!



Weather

Individuals conscientiously observe the weather, code it on a map and prepare it for dispatch to the forecasters.

or *Not*....

Major Lewis J. Neyland, Ops AWS, MATS

Breathes there a pilot with soul so dead
Who never to himself hath said —
That weatherman should have stood in bed

(Apologies to Mr. Scott)

ONCE UPON a time, long, long ago, there was a weatherman who had never busted a forecast. Then one day someone forced him to make one and his record was broken.

Yes, forecasts do go astray. As a matter of fact, the AWS can tell you quite accurately what percentage of any large group of forecasts will bust. For instance, just about dawn this morning some 220 AWS weather stations prepared eight-hour forecasts for their own terminal weather. If today turns out to be an average one, 95 of these forecasts will prove that the forecaster needs a new crystal ball.

Recognizing that forecasts cannot always be accurate, it is obviously poor judgment to place yourself in a position where unexpected bad weather costs you your airplane. Until we have a major "break-through" in the science of meteorology, a busted forecast is not a valid excuse for an accident except in very unusual operational circumstances! This being the case, let's take a real serious look at the "state-of-the-art" of meteorology so that you and I, as pilots, can intelligently utilize the services of the Air Weather Service.

Every forecast has better or worse odds of being correct. What are those odds and what can I do to allow for them? Those are the basic questions. The dissertation that follows should help you to answer them.

Considering only the weather activities directly related to providing you with a forecast for your next flight, let's look briefly at the setup supporting your forecaster.

Did you know, for instance, that there are over 10,000 internationally recognized weather stations in the world-wide surface weather observing network? The Air Weather Service operates 226 of them. In addition, there are hundreds of upper air observation units and about 20 scheduled aerial reconnaissance tracks. The AWS operates 53 of the upper air stations and its aircraft cover 14 of the reconnaissance tracks.

If it happens to be a scheduled observation time now (while you are reading this), there are well over 10,000 people doing their best to describe their little portions of the beast that is the weather. Meanwhile, at forecast stations over the world, pilots are probably being told in English, French, Turkish and Russian that "The new sequence will be on the teletype in a few minutes; let's see how it looks then."

The first part of the problem then (and one which is in no sense adequately solved) is to accurately describe the weather that is out there right now.

Reminds me of the clear, calm summer night at Luke Field some years ago when the ops officer turned the lawn sprinkler on the weather station windows and then came in dripping wet with a Form 23 (DD Form 175 to the youngsters) asking for a briefing. I refuse to identify the duty forecaster or disclose the erroneous forecast he gave (UP Art 31, UCMJ); suffice it to say, if you have the wrong picture of the present weather your chances of coming up with a good forecast are mighty slim.

So we have these 10,000 plus individuals conscientiously observing the weather, coding it up and sending it off to the forecasters. Each observer can see only a little patch of sky, generally only the bottom of whatever weather is in his neighborhood, so his idea of what is going on is at best an approximation. (This is why your PIREP is so important.) He takes this estimate and translates it into one of the various weather languages (codes). These codes are only occasionally ambiguous, and certainly are concise, perhaps to the point that even if an observation were a completely accurate representation of the present weather, the observer couldn't convey a wholly true picture to the forecaster many miles away.

Be that as it may, coded weather observations are the building blocks the forecaster must use in making the prognosis for your flight and you can see that right off the bat there are built-in errors.

Knowing roughly what the weather was at the time of the last observation, the forecaster must decide how fast and in what direction the weather is changing. That should be a fairly straight-forward problem (and sometime in the foreseeable future I think it will be). All weather processes are governed strictly by the natural laws of physics; for every effect there is a perfectly logical physical (mathematical) relationship to the corresponding cause. The villain in this script, however, is that even the best brains in the business (and we have some real crackerjacks working on the problem) have not yet been successful in

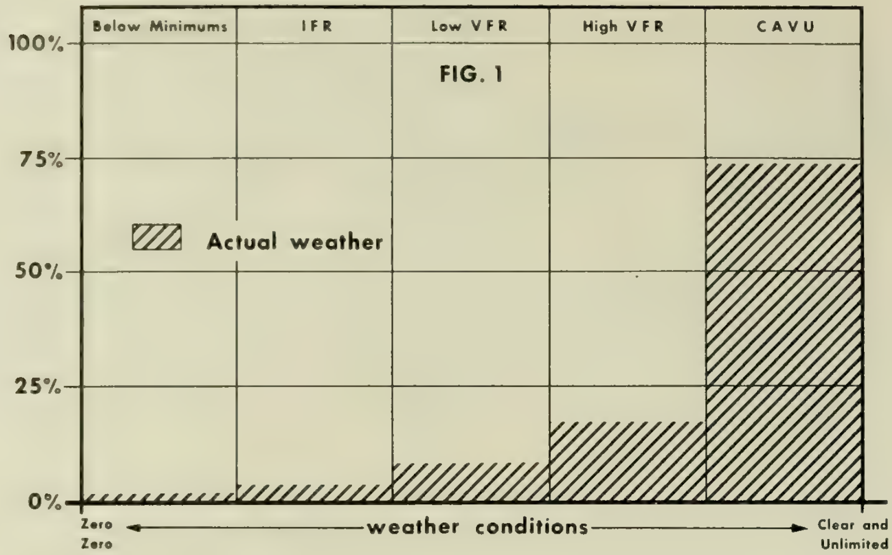


FIG. 1

Weather conditions that actually occurred when the forecasters predicted very good weather.

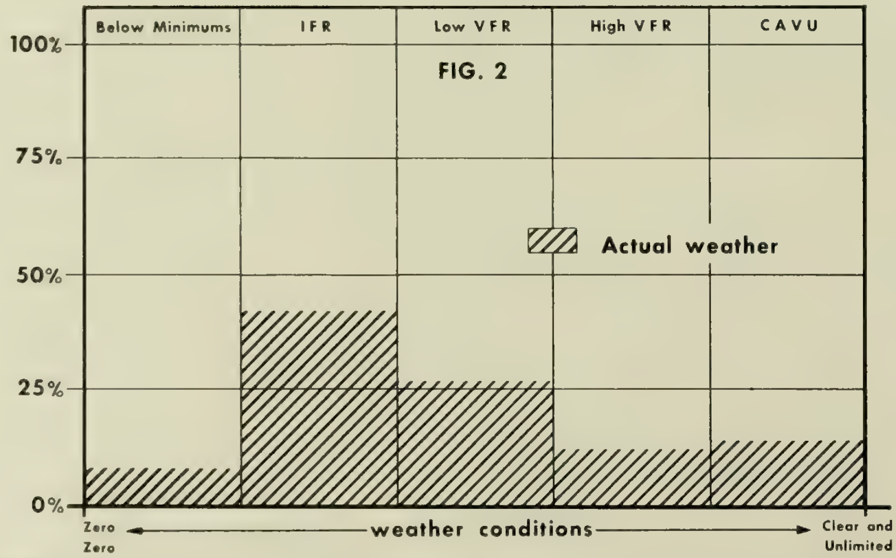


FIG. 2

When the forecast called for IFR, this is what happened. Thousands of forecasts were checked.

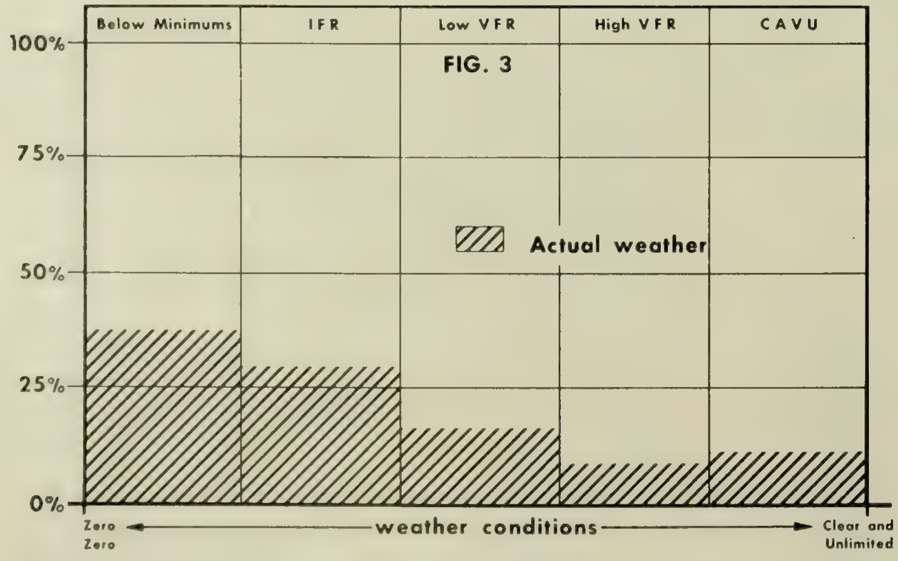


FIG. 3

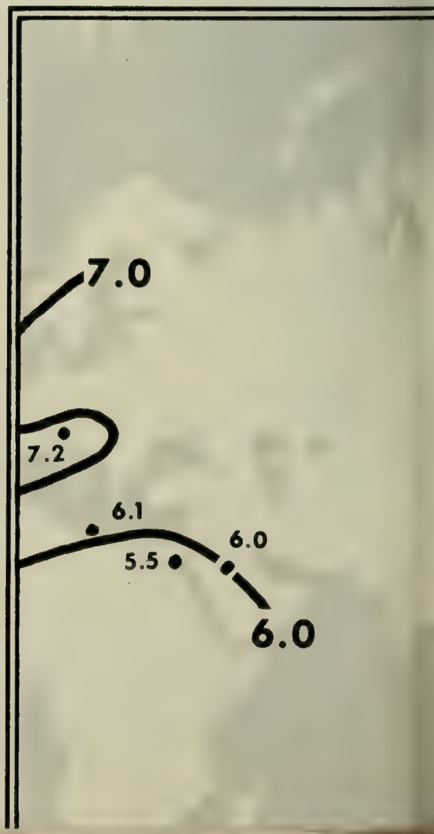
When the forecast called for "below minimums" this is what actually happened to weather.

defining many of these cause-effect relationships in weather.

Progress is being made—the "big brain" of the Joint Numerical Weather Prediction Unit, under the guidance of some half dozen gents with numerous Ph.D.s and Masters Degrees between them, takes a formula as long as your arm and makes a forecast of the 500 mb flow pattern for a time 30 minutes into the future. Starting from there it makes another forecast for a time 30 minutes later and so on until it comes up with a forecast of what the 500 mb chart will look like 24 to 36 hours in the future.

This machine at the present time does only a little better than the experienced duty forecaster at your base weather station, who by the way is no dummy either. You might be interested to know that one of the last two weather officers who briefed you has five or more years of college training and three of the last four had at least a college degree. These boys have the best training that money can buy. But the demonstrated fact that the "intuitive" forecaster can often equal (and sometimes beat) a purely scientific forecast shows that even the best sometimes leaves something to be desired.

Knowing all this, you walk into the weather station to get an important forecast from the weatherman whose



knowledge of the present weather is inherently somewhat distorted, and who has only stone-age caliber tools to translate it into a forecast. What will you get and what should you expect to be able to do with it?

How Good Were They

In order to be able to give their customers an accurate statement of the odds involved in using weather forecasts operationally, the AWS has conducted several comprehensive forecast verification programs. These have checked the accuracy of forecasts of terminal ceiling and visibility and of route winds. Be sure to remember when reading the following that the figures are based on world-wide averages and are not directly applicable to a specific base.

The verification procedures were quite straight-forward and were specifically designed to measure forecast validity in operational rather than purely meteorological terms. For example, terminal weather was categorized into five operationally significant groups (below GCA minimums was one category, 200 feet ceiling, one-half mile visibility to 1000 feet ceiling and three miles visibility was another category). Each terminal forecast was then compared with the actual weather which occurred. If the forecast and actual weather fell within the same category it was scored a "hit," if not, it was a "bust."

Forecasts for periods ranging from three hours to 24 hours were checked.

Let's see just what all this gobble-de-gook means to you in planning your next flight. Figure 1 shows that if you clear to a base that is forecast to be clear and three or better, odds are roughly three to one that the weather will be that good when you arrive. One time out of 50 you will find the weather to be IFR and about one per cent of the time it will actually be below minimums.

Below Minimum Forecasts

On the other hand, if you are clearing to a base that is forecast to be IFR upon your arrival in three hours, you had best be prepared with a sound alternative course of action because, as Figure 2 shows, once out of each 14 times the weather will be below minimums. To me, this means that the smart man (particularly in a jet) will check the latest forecast before he leaves his cruising altitude at destination, because in spite of what he was briefed on, sometimes he will get down there and find the field all clobbered in. When that happens, he may not have sufficient fuel to execute a missed approach and then go on to his alternate.

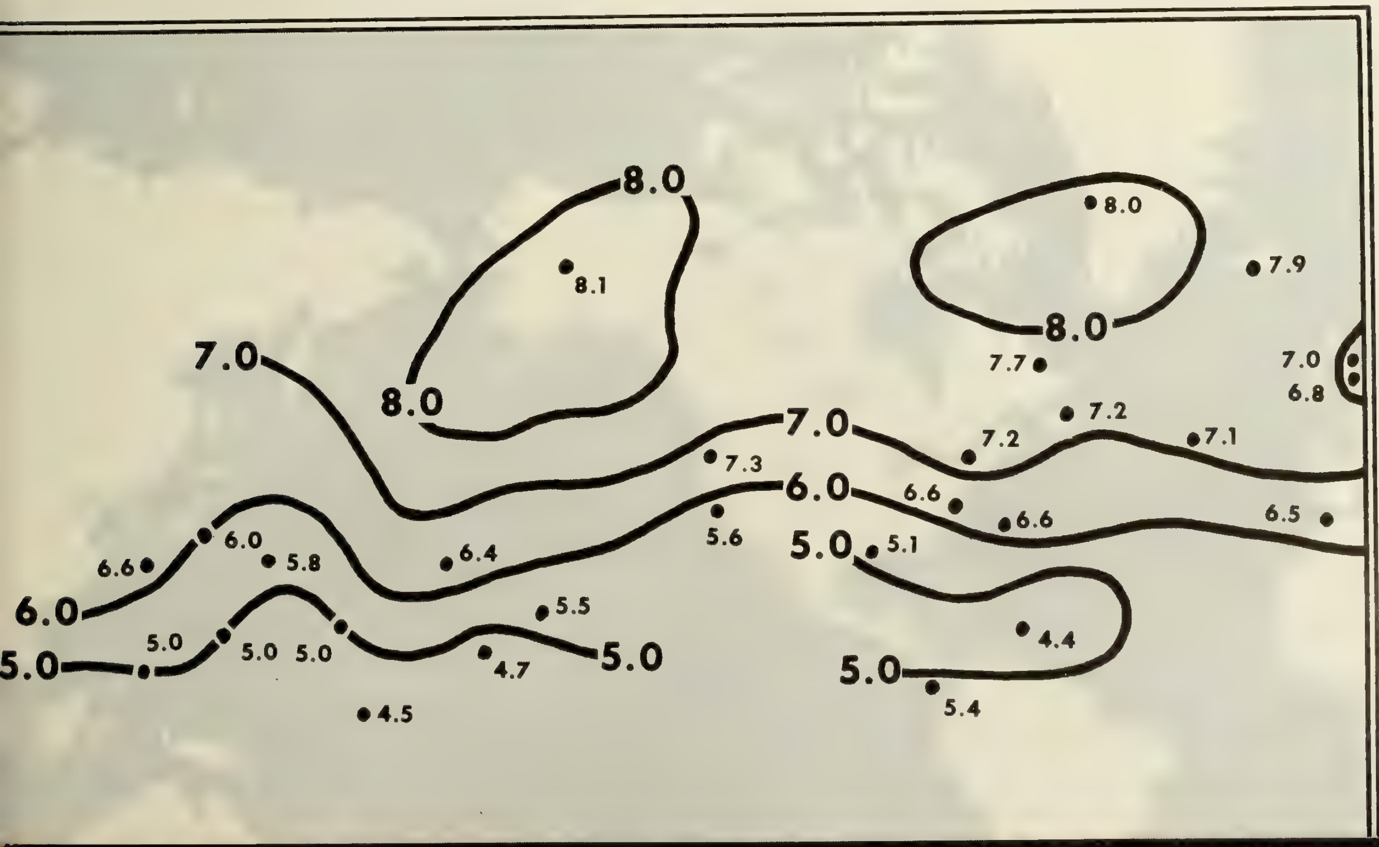
On the average, only about four per cent of all forecasts will call for "below minimum" weather. However, when that's the word from the forecaster but some emergency requires you to make a stab at it anyway, take heart, because the odds are actually almost two to one that the weather will be *above* GCA minimums when you get there. Figure 3 gives the statistical scoop on this situation.

VFR or Not

Leaping off on a cross-country flight without your letdown book is never smart but that is particularly true if the weather is forecast to be marginal VFR. The AWS study shows that one out of every seven forecasts of low VFR terminal weather proves to be too optimistic and the actual weather turns out to be below VFR minimums.

The meat of Figures 1 through 3 is that the better the weather is forecast to be, the more likely it is that the forecast will be correct—and vice versa. There are several reasons for this. Perhaps two of the most important are that a small change in ceiling or visibility in bad weather is much more operationally significant than the same change in good weather. The other reason is that over most of the world, good flying weather occurs oftener and lasts longer than does the bad weather.

Wind factor error (in knots) of all stations for which data from over 100 flights were tabulated.



Winds aloft forecasts were verified in terms of Forecast Wind Factor (FWF), and Actual Wind Factor (AWF) using this formula:

Error=AWF-FWF

Since Wind Factor (WF) is ground speed minus true airspeed (WF=GS−TAS), error is expressed in knots with Plus Error meaning that the Actual Wind was less handicap than forecast (you got there ahead of ETA). Minus Error, of course, means that the wind was more adverse than forecast (less tail or more headwind than forecast).

Verification of winds aloft forecasts (primarily on long overseas flights) showed first that forecasters were not being consistently pessimistic or optimistic since all errors almost balanced out to zero (+1.4 knots).

However, more important operationally is the Mean Gross Error—simply the average wind factor error disregarding all the plus or minus signs. The AWS-wide Mean Error was 6.0 knots based on data from 59,022 overseas flights during the period from December, 1951, to December, 1955. This means that if you receive a wind forecast of average accuracy for your next overwater flight, your actual wind will be within six knots of the one forecast for you.

Figure 4 shows that the accuracy of wind forecasts is not the same throughout the world. We must discount the possibility that this is a function of the skill level of individual forecasters, since during the four-year period represented by this data, each station should have been staffed by a representative cross-section of AWS forecasters. The difference then must be related to the number of reports available to the forecasters and the changeability of the wind flow patterns in the various areas.

All Is Not Lost

Lest you decide from all this that USAF weathermen aren't earning their salt, it's only fair to point out a couple of things in their favor.

First, there is tremendous effort being expended to develop techniques to forecast operationally dangerous weather phenomena. The development and application of the Severe Weather Warnings in the ZI is an outstanding example of progress in this line. Although occasionally an SWW doesn't pan out, they have proven to be so accurate that most of us fly into Severe Weather Warning areas only when necessary and then only VFR if at all possible.

Second, I have yet to find anyone who has actually used the forecasts of other weather services who has not found the AWS operationally tailored forecasts to be superior to any others. To compensate in part for the inadequacy of the science of meteorology the AWS forecaster goes to great lengths to become very familiar with the details of the operation for which he is forecasting. Have you ever had the feeling that the forecaster was being too inquisitive about your plans? It's not just idle curiosity. The more he understands your mission, the more operational value his forecasts will have for you.

Get the Latest Odds

If you were at Santa Anita you'd never bet on a nag straight one to one odds if you could get ten to one at the pari mutuel window. In all the discussion and charts above the forecasts were accepted and scored against one to one odds, i.e., they were either right or wrong.

Their operational value can be greatly increased, however, by taking advantage of the running odds which we can call The Confidence Factor. There are many weather situations that are clear-cut, where the forecaster is highly confident that his forecast will verify. Here the odds are with you so take advantage of them. Likewise, there are situations where the forecaster knows that odds are about even that the weather will be (for example) above or below minimums. This is the time to be very cautious.

In those doubtful situations you do yourself a disservice by insisting that the forecaster give you a clear-cut, black or white forecast. It would be more realistic to evaluate, with the weatherman, the odds of being able to complete your mission, determine whether or not the odds are acceptable in view of the urgency of your mission, and if so, to plan your flight with a sure alternative course of action always available.

Conclusions

We all know that weather can be a critical factor in our flying operations. Realizing that forecasts cannot be 100 per cent accurate, it makes good sense to find out how confident the forecaster is of his forecast and to take this into account in your premission planning. Planning a peacetime flight into a situation where a "busted" forecast will result in an accident is closely akin to playing Russian Roulette and is just as illogical. The same is true throughout the entire execution of a flight. Right up until the time you must commit yourself to landing, keep a close check on the latest forecast as well as actual weather and if there's the slightest shadow of a doubt, leave yourself an alternate course of action. ●

DO'S and DONT'S

DO remember that forecasts carry no guarantee of accuracy.

DO remember that the fresher the forecast, the more accurate it is likely to be.

DO remember that your forecaster is highly qualified—that if he can't forecast it, probably nobody can.

DO always check the latest forecast before you commit yourself to land.

•

DON'T plan a flight where a "busted" forecast will automatically result in an accident.

DON'T forget to keep checking the weather ahead while you are en route.

DON'T get yourself in a hole where you have no alternate course of action.

WELL DONE

★ ★ ★

Captain

Robert J. Kilpatrick

302 Tac Recon Sq

CAPTAIN ROBERT J. KILPATRICK was finishing a Tactical Recon mission in an RF-80. As he entered his initial approach for landing, the airspeed read 300 mph, the speed brakes were out and the throttle was set for 50 per cent power. As Captain Kilpatrick started a roll-out to line up with the runway, he felt a thump on the control stick. The aircraft immediately went into a nose-low attitude.

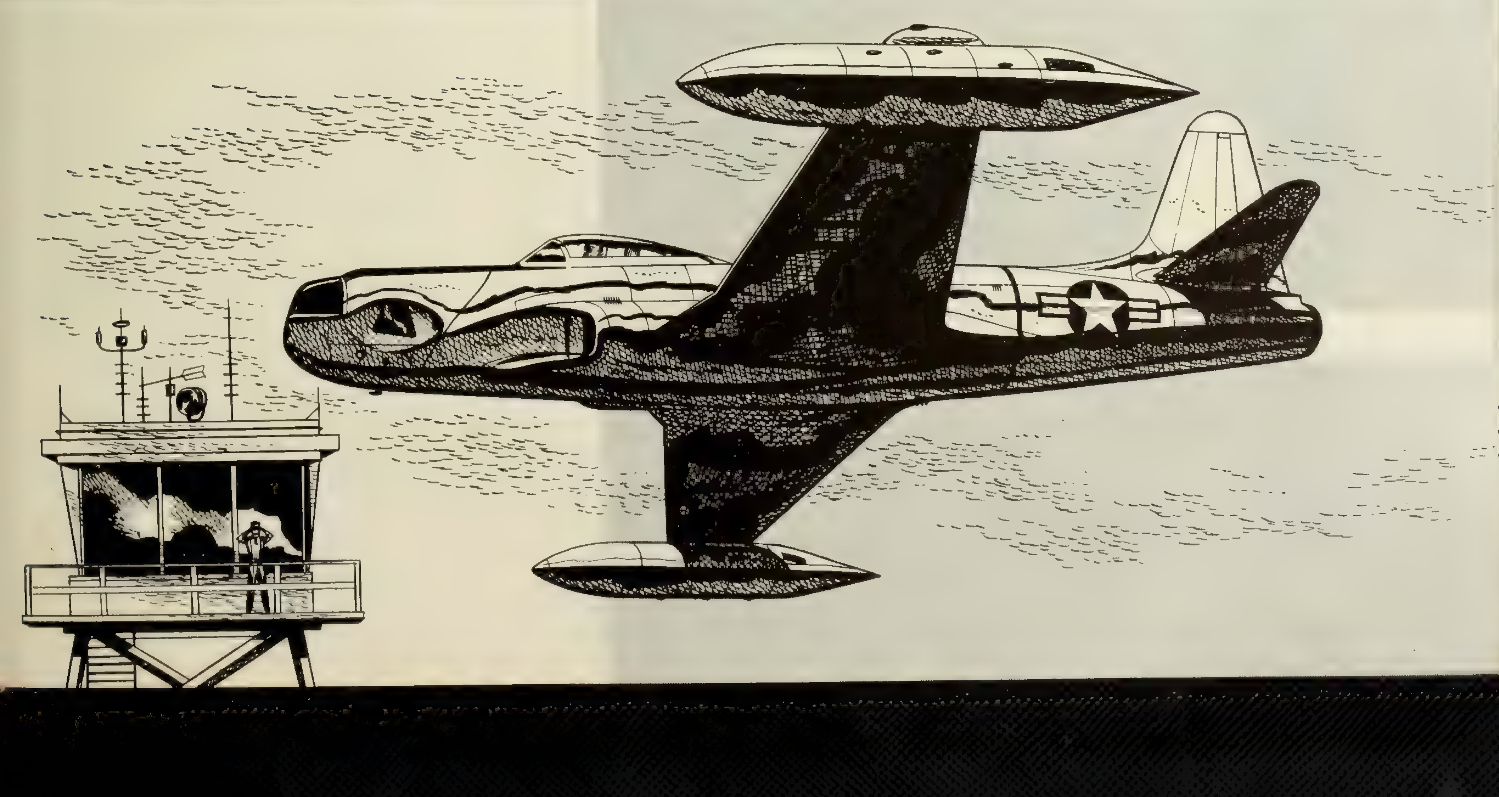
He pulled back on the stick but it would not move past the neutral position. By using both hands on the stick and decreasing his airspeed, he was able to maintain level flight. He found that he could climb at a very slight angle at around 200 mph.

Thinking that something had come loose and was lodged against the elevators, he flew by the control tower to have it checked. He was informed that something was sticking up behind the canopy. He turned and was just able to see the cause of his trouble . . . the upper engine access door. He had checked that before takeoff. It was okay then but now it was sticking up and was jamming the elevator push rods.

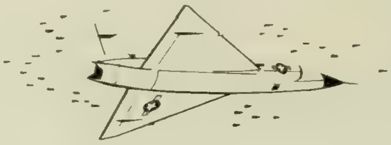
Captain Kilpatrick experimented. He found that he could not control the airplane at speeds below 180 mph or above 200, with the gear and flaps up. When he put the gear down he found that he could control it at speeds down to 152 mph. He knew that flaps would only increase the diving tendency.

Controlling his descent with throttle, he approached for landing at 160 mph. He touched down nosewheel first but braked to a normal stop 6500 feet down the runway.

To his alertness, his ability to analyze his difficulties and his knowledge of the airplane, Captain Kilpatrick added professional skill and judgment. Well Done!

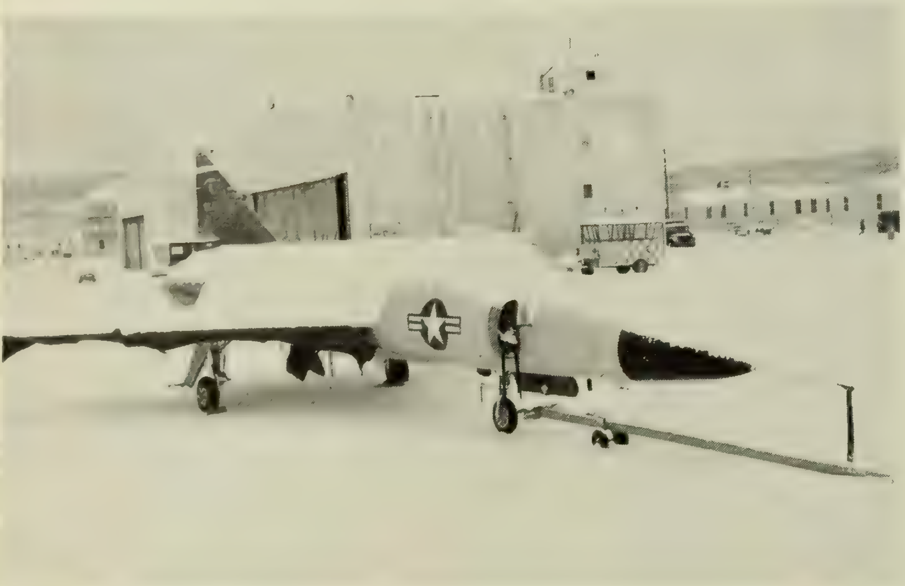


Here is an article on flying the F-102 under severe, winter conditions. It is prepared by the pilot who performed the tests, and covers everything from the preflight to landing.



Captain Tracy B. Mathewson

the 102



Outside all night, in the snow, let's look it over good. Clear speed brake and drag chute area.

IT WON'T BE long now! Some of you all-weather interceptor jockies will be herding the F-102A around the skies. Naturally, you're going to run into the same old problem as far as the weather is concerned. You'll have clear weather, good visibility, low ceilings, poor visibility, hot and cold, rain, snow, sand and everything else the Old Girl can dream up to throw at you. There's only one way to always come out on top of the pile and that's to be prepared for anything that may come your way.

Perhaps a few words here on cold weather operation of the F-102 may assist you in your personal program of preparedness.

Let's take a typical cold flight, including the planning and post-flight procedures which are necessary to accomplish your mission and terminate it with a real cool landing.

The Paper Work

First off—the weather, existing and forecast, NOTAMS, and aircraft. The weather is suitable. It's cold, say about 20 below on the ground; overcast about 3000 feet and visibility five miles. The runway is icy; there are snowdrifts along the taxi strips and runways. Remember the temperature in degrees Centigrade. You will need it to make the proper adjustment on the ratiometer prior to takeoff.

We have filled in all of the little blocks on the clearance, and the plane is ready to go. Wait a minute, now. Before charging off, we should check a couple of items. First, as always, the Form 1. Read it and make sure you understand all the writeups.

Walk Around

Now, let's look the airplane over externally. If you're a tire kicker,

. below zero

After start-up and before taxiing, be certain to check for any external leakage in fluid systems.

there are three tires to check. If you want to do a thorough job and come out on top of the pile, then follow me—we'll do it up brown.

Check the left intake duct for foreign objects—snow, ice; and security of panelling — the forward electronics bay doors, secured; the pitot tube and mast—see that it doesn't have any snow or ice in it or on it.

Check the nosewheel tire, strut, safety lock pin, steering damper pin, battery and taxi light. It is important here to see that there is no hydraulic fluid leakage around the nosewheel strut. This may occur when the aircraft is towed in cold temperatures.

Give a check of the nosewheel well switch panel and make certain the switches are in the correct position. Remove any ice formations which may be in or around the gear or well. Check the right side forward electronics bay doors; remove ice that may be there and check for any leakage which may be apparent.

Inspect the leading edge of the wing for ice and damage. Now let's look in the Ram Air Turbine compartment. Here we check the fluid level in the hydraulic reservoir. There are two small pressure gages located in here, too. They are on the hydraulic accumulators and each should indicate 750 psi.

Take care to note the reading, especially if the bird was serviced in a warm hangar, then brought outside to sit in cold temperatures. Now see that the blades on the Ram Air Turbine are free of ice and will rotate smoothly.

Check the condition of the compartment door and close the door. This brings us to the right main landing gear and wheel well. Make certain there is no ice on the gear and that the strut extension is correct.

Tire condition and inflation are important, too. See that the ground safety lock pin moves freely and is not frozen in the gear; this may save you a little delay after starting.

Give a check on the high pressure pneumatic gage; it should be 3000 psi. Watch this in case the aircraft was serviced in a warm hangar. See that the fairing doors are in proper condition and connected to the retracting arms. There's a circuit breaker panel in the main wheel well; make certain the circuit breakers are all in and are clear of ice.

As always, preflight planning is a must. Do it right.

Check wing cleaning operations closely. Remember you are flying it.

Take time with your walk-around. It's more than just tire kicking.

On the underside of the wing, there are three fuel tank vent valves. Look at these vent valves closely. With extremes in low temperatures, the valves have a tendency to leak. If there is any ice formation around a valve, take care — you may have condensation moisture in your fuel plus the fact that you have a leaky vent valve.

Have a look at the elevon for ice formation and general condition. That puts us at the tail cone of the aircraft. Normally, the speed brake will be left open so the drag chute can be installed. This is an ideal condition to have the chute pins frozen in the inserted position. Don't let this happen to you. Clear the ice away from the chute area. Now, see the two little pitot pickups 'way up on the leading edge of the vertical stabilizer? They are dynamic pressure pickups and apply signals to the trim actuator to provide trim changes in a certain Mach range. The system prevents a reversal of required pilot applied forces to maintain level flight as the airplane is accelerated or decelerated through the trim change speed band. You wouldn't want to be without this assist, so check the pickups and make sure they aren't cluttered up with frozen water. By the way, if you leave the covers on, you will get the same results as the ice would cause.

On the left side we will check the elevon, landing gear and wheel well. The single point refueling receptacle is in the aft face of the left main wheel well. Make certain it's not leaking and the entire area is clear of ice. There are also three fuel tank vent valves in the left wing so make the same check as on the right side.

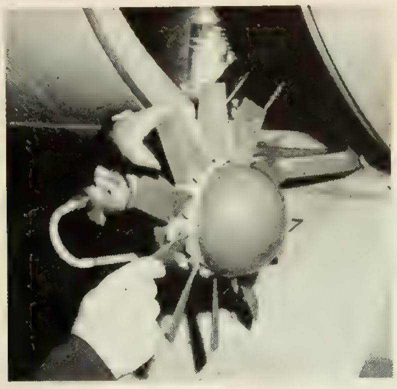
Another item that may be important: Check the fairing cover on the external emergency canopy jettison. Make sure it's not frozen closed. Make certain the old girl is securely chocked. Extremely cold weather plays havoc with hydraulic, pneumatic and fuel systems, so if you make a quick preflight, at least look at these systems.

The Interior

Okay, looks like she's in good shape. Let's climb in and crank up. Watch that ladder. It rests on the upper skin of the left intake duct. When this area has any ice or snow on it, the ladder has a tendency to slide forward, down the duct slope. It will unceremoniously deposit you on the ramp. Use care when entering the cockpit. There is an anti-glare shield mounted over the instrument panel which becomes very brittle in cold weather. If you kick it or hit it when entering the cockpit the aft corner may break off.

In the cockpit, the usual checks are made. There are some items, however, to which special attention should be given in cold weather. First, let's get hooked up. Pay special attention to the safety belt. Make sure that the buckle isn't frozen. Open and close it at least twice. Check the shoulder harness and make sure the reel isn't frozen or sticking. Give your oxygen mask a good once-over. The flapper valve has a bad habit of freezing closed. Before you start the engine,

Uncover, clear the dynamic pressure pick-ups.



Be sure these turbine blades are free of ice.

Note cold weather items during cockpit check.

After getting a good systems check you are ready to go. Don't pull chocks until ready to go.

check all of the movable switches and knobs. I've found that they will freeze up and you can't move them, particularly the VOR frequency selector. The low temperatures also have caused contraction of the set screws in the selector knobs, making it impossible to select various positions on some of the radial selectors. In one instance, a knob fell off the shaft. Embarrassing! Better to find out on the ground.

The Start

Now we're set to start. I won't go through the start procedure because you will learn that from the pilot's handbook when you check out.

There are several words of caution during starting. If the airplane has just been subjected to sub-zero temperatures, the automatic starting sequence fuel will probably be set slightly low for the cold weather and the first start may be unsuccessful. You can accomplish the start on the emergency fuel system or have the starting fuel adjusted. During the start, check the primary and secondary hydraulic systems gage for a smooth increase in pressure. An erratic or excessively slow pressure rise is an indication of a pump going bad.

Watch the engine oil low pressure warning light during this start. We all know what low temperatures do to oil. After the start is completed, have the Gas Turbine Compressor disconnected, reset the AC and DC generators, then wait at least two minutes before having the external electrical power disconnected. This delay is to allow the oil in the Sundstrand generator unit to warm up and begin circulating properly.

After the external electrical source is disconnected, give the primary and secondary hydraulic systems a thorough check, making certain they return to system pressure in the required two seconds. You will probably have to cycle the flight controls at least three times before the hydraulic fluid begins flowing rapidly enough to return the pressure to normal in the specified time.

Get a check of the emergency AC power system. The emergency alternator is driven by the secondary hydraulic system, so the emergency AC power check will also give you some insight as to the operational capability of the secondary hydraulic system. Have the speed brakes operation checked by the crew chief for smooth retraction and extension. The only other item you may have any trouble

Use brakes and power with care when taxiing. Lined up with full power, brakes won't hold.

After takeoff, the gear may retract slowly in cold weather. Don't exceed the placard speeds.

with at this stage is the takeoff trim. I found the trim actuators were invariably slow after the airplane had been cold soaked. Operate all the trims from one extreme to the opposite extreme and leave it there. Then check the takeoff trim for centering and trim rate. Let's lock the canopy down and get the show on the road, our weather is about to expire.

When locking the canopy down, unless you're wearing gloves, move the locking handle forward slowly or you will leave some knuckle skin on the side wall rivets. Pull the chocks, Chief, and we're off. Watch it when you're taxiing on ice or packed snow. In this airplane, the nosewheel steering is a lot more effective than differential braking for directional control. The brakes have a tendency to make the aft end of the aircraft skid rather than turn the nosewheel.

Another item on taxiing: In case you get the nosewheel turned out of the 50 degrees steering control limit, use extreme caution in trying to get it re-engaged. A little power will cause the airplane to start to skid and there you are — in a snow bank. It may make your face red but it's a lot cheaper to have a crew man come out and straighten out the nose gear until the steering mechanism engages.

I won't go into the pre-takeoff checks here. They are all straight forward checks that never appeared to be affected by low ambient temperatures. IFR? Okay. Lights, pitot heat. Don't worry about that 90°C. exhaust gas temperature. It normally indicates very low at ambient temperatures of below zero.

Off and Running

The tower has cleared us to line up and we're all set to go. Run up the engine, check the instruments and keep an eye on things outside. This job will begin sliding on snow or ice at about 80 per cent rated power even with the brakes locked. At military power pop it into afterburner. Now don't just sit there because by this time (5-7 seconds) you're skipping through the dew. This cold weather really wakes up the '102. You're liable to get the aft end to skidding excessively if you don't stay right on the directional control. There will be some skidding of the main gear apparent but you won't be on the ground long.

We're off. Now watch the acceleration; you're going to exceed the gear limit speed if you don't pull the nose up. The gear is usually pretty stiff and slow on retraction after sitting in subzero weather. This is very important to remember because you will certainly pull a gear fairing door off if you exceed the placard speed. With the thrust available at low temperatures, the climb angle of the airplane is pretty steep by most of our standards so get on the gages and concentrate. The airplane flies like any conventional planform so let's get on with the mission. Watch that altimeter. Going up like a homesick angel.

GCI picks us up, vectors us out; we make a few practice intercepts, then return for a letdown and landing. It's cold and cloudy; get the pitot heat on. Remember the dynamic

Wouldn't want to get caught short here. Thorough knowledge of aircraft procedures is a must.

pressure pickups on the vertical stabilizer? The pitot heat will also keep them cleared for you. Windshield deicing? Don't let it get ahead of us, turn the NESA glass switch on before we start down.

A quick check of hydraulic pressures and electrical system, then we're in the penetration. Icing of the wings doesn't appear to be a problem; it forms lightly, then peels away. GCA has us now, final cockpit check completed, gear down and indicating locked. Just broke out underneath, cancel IFR, we'll finish the approach and landing visually, over the fence and over touchdown. Careful now, you're cocked way up in this bird for landing, about 15 degrees. That places you about 18 feet off the ground when the main gear greases on. It is difficult to obtain a good depth perception over a snow-covered runway so carefully maneuver to maintain the correct attitude and speed. There, the main gear is on; deploy the drag chute and be ready to correct any skidding with rudder. Ease the nose down and carefully apply the brakes. On the ice or snow you can easily skid a tire with brakes and melt the rubber down to the cord before you realize it. Intermittent braking and nosewheel steering is the best combination. The nosewheel steering is very sensitive above 50 knots; use it with caution. Keep the aircraft straight or it will start fishtailing and try to skid. When deploying the drag chute in crosswind, you will realize only a light component of the crosswind effect due to the drag chute. The riser connecting point is about 15 feet behind the main landing gear and about 37 feet behind the nose gear so the lever arm action of the chute is negligible. It may create a small fishtailing effect about the main gear but the yawing moment will be very slight. Check the pitot and NESA heat off now. Taxi in slowly. The tires may break through the packed snow and cause damage if you're too fast. Give the hydraulic systems a final check prior to engine shutdown. You may notice a potential failure. Check the electrical systems again, it only takes a second or two. Into the parking spot, chocks in; leave the speed brakes open, please, the crew has to repack the drag chute. Shut her down according to your Dash One and listen! Sounds normal? Okay, fill out the form, give the cockpit a final check and position all the switches properly. Seat safety pin in. Good gosh! It's getting colder; must be 25 below, now. Let's go and have a cup of coffee.

Taxi in slowly using nosewheel steering. Braking could cause a wheel to break through the snow.

Existing conditions and local requirements for scrambles will dictate how much of the preflight is performed before the whistle blows. For practice, or training flights, don't miss a bet. Always look it over carefully; know the condition of the bird and I'll see you at 45,000 feet over the field. First one there gets to lead the flight! ●

Keep Current

NEWS AND VIEWS

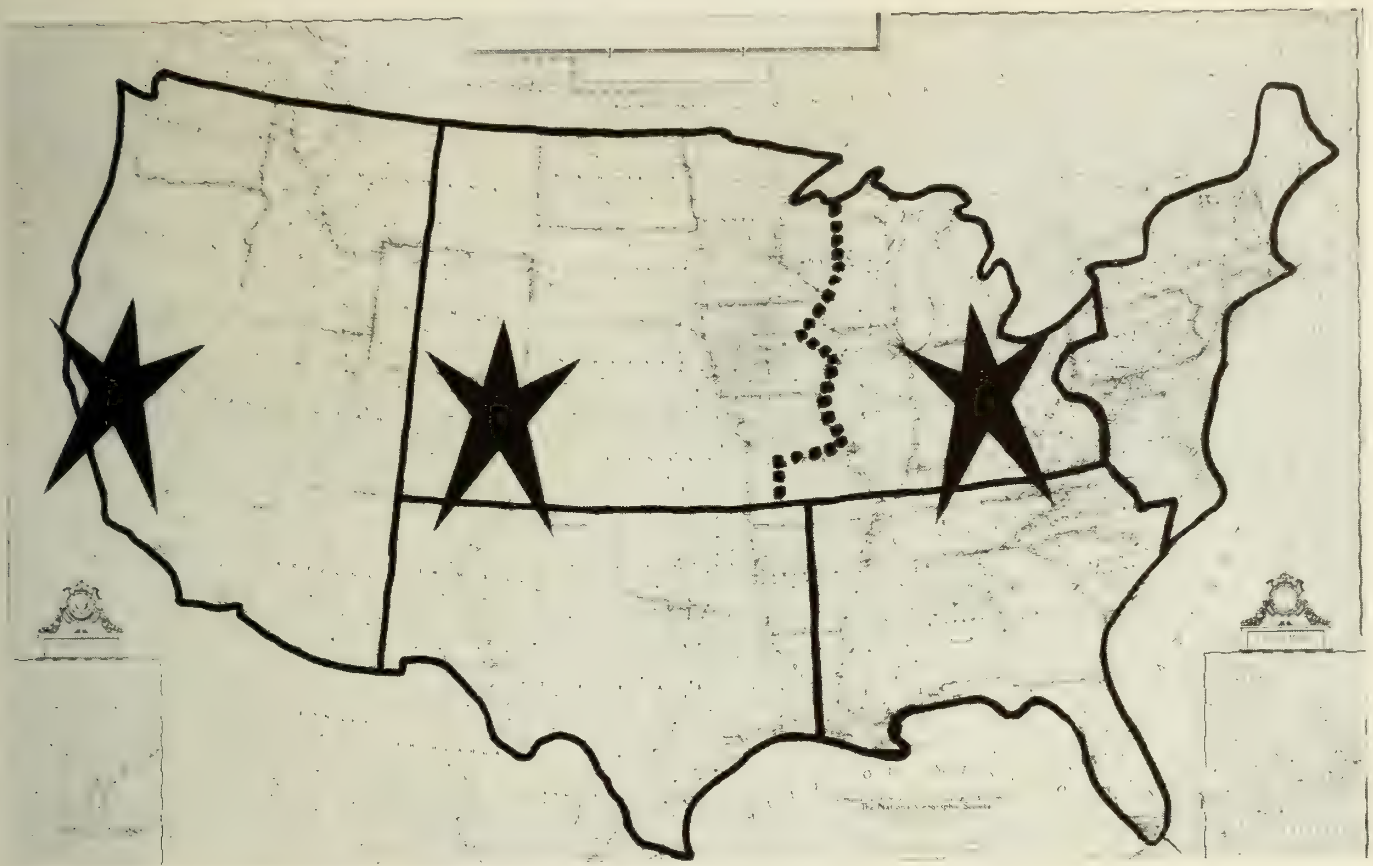
The world's first successful convertiplane is the McDonnell XV-1.

Speedy Chopper— Hailed as the world's first successful convertiplane, the McDonnell XV-1, has set a new unofficial speed record for helicopters. The mark is now 200 mph. Previously, a convertiplane of the same type set the mark, again unofficially, at 180 mph. The official record for helicopters is 160. The convertiplane is said to have excellent handling characteristics and minimum maintenance problems. The trick of this craft seems to be that of converting from helicopter-to-airplane in flight. This is done through a complex rigging of controls and a combination of engines. A conventional engine with a pusher propeller provides one element of power, while a specially designed pressure jet installed at the tip of each rotor blade provides the other component.

The XV-1 recently concluded an intensive flight evaluation program conducted by an ARDC flight test staff from Edwards AFB, Calif.

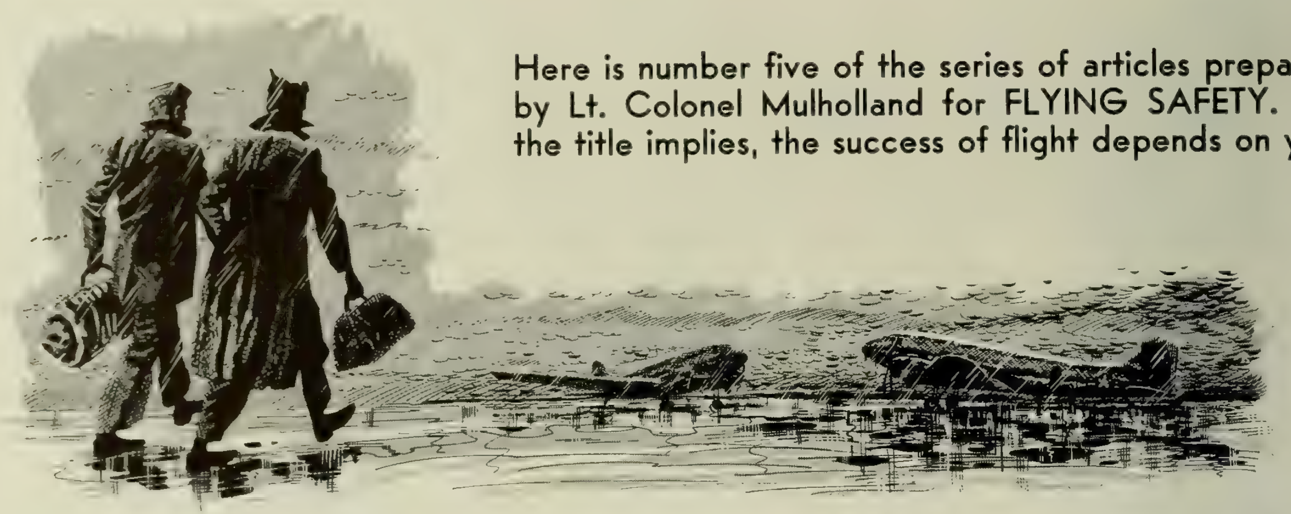
How High Can You Get?— Seems that a couple of our South American neighbors are having "some kind of a contest" with T-Birds. The object seems to be: Who can fly a T-Bird into and out of the highest airfield? First, it was reported that the Peruvian Air Force had operated a T-33 out of Limatobo, Peru (elevation—8100 feet).

This sort of challenged certain members of the Colombian Air Force. Nothing daunted, they flew one of their T-33s to their own field at Bogota. The elevation there is 8398 feet and the runway length is 7000 feet. The pilots shot three touch-and-go landings before they decided to try for a full stop. But try it they did—and made it. They landed with 325 gallons of fuel aboard. They took off again, and as we often hear, the flight was "routine."



Flight Service Shift— Flight Service Centers are scheduled for change. March Flight Service Center is being consolidated with Hamilton. After the shift (early October 1956), Hamilton Center will assume responsibility for the combined area. Future plans call for closing both Lowry and Wright-Patterson centers and establishing a new one to serve the combined areas. The dotted line marks the present boundary separation. Carswell, Olmsted and Montgomery centers remain.

Pictured at right is the two-place version of the Super Sabre F-100. Below depicts the net devised to literally "scoop up" downed airmen.



Here is number five of the series of articles prepared by Lt. Colonel Mulholland for FLYING SAFETY. As the title implies, the success of flight depends on you.

Know Thyself

Lt. Col. Mitchell J. Mulholland
Safety Research and Analysis Div., D/FSR

IT'S A DARK and nasty night. Out on the rain-swept ramp a Gooney bird is half revealed in the glow of the floodlights. It has been run up and checked, a patient beast ready to do its pilot's bidding.

In operations the pilot and copilot are running through all the necessary preparations for flight. The string on the big wall chart, the NOTAM file, the weather section—ugh! What a night! Fill out the clearance. Room for any passengers? Sure, eight extra chutes on board. Bring them on!

In Your Hands

So here they come. Private First Class Snodgrass, Battery A, Umpty umpth FA Battalion, on emergency leave; Seaman Hawser of the U.S.S. Oddsfish, off to join his ship, all the rest of them, humbly and gratefully drag their baggage out across the ramp to their free ride. If any of them are a little apprehensive about the weather they say nothing—after all, they're in good hands.

Or are they? How about it, Captain? You're giving these people a free ride—are you sure where? How current are you in this airplane? How much weather time—recently? This is a pretty ugly night and there are mountains around here. Can you really cut the mustard? Maybe you're a little rusty and you figured this flight would be just the thing to sharpen you up. If so, what is the role of Private Snodgrass and Seaman Hawser? And Mrs. Snodgrass and the kids? Are you really going to give them a helping hand, or are they just bit-players in the drama of man versus elements on which the curtain is about to be raised?

Wasn't it old man Socrates who said, "Know thyself?"

Apparently he knew a thing or two because his advice is still most timely after all these years. Nobody really knows an individual's capabilities and limitations like the individual himself, if he is honest about it. If you're confronted with a tough job, nobody knows better than you if you can really hack it. Self-evaluation works both ways — confidence, self-assurance are the by-products at one end of the scale, prudence and caution should lie at the other. Not cockiness, not timidity — these are extremes which should not appear on the scope. In short, honest self-appraisal tells a man just how good he is—not how good he would like others to think he is.

So where does this leave our pilot on the rain-swept ramp? Should he go on, take his trusting passengers into the wild black yonder, or should he forget the whole thing and take in a movie? Assuming all requirements and directives have been complied with, he has a perfectly legal right to take off. Morally, only he is the judge as to whether he is justified in pushing this thing or not. Is he in a rush? Does he know, deep down inside that this flight is going to be a hairy one, that his hands are going to be full? Is he at least partially gambling that the forecaster was overly pessimistic, and that every-

When it comes to flying, good self-evaluation is in order. Can you really cut the mustard?

thing will probably work out okay? Unless he is absolutely sure of his capability to hack this flight, it is his moral obligation to himself, Uncle Sam, and to his crew, to say nothing of Messrs. Snodgrass and Hawser and the others, to cancel this whole project until things look more auspicious. This is not the time to indulge in training—this flight is for keeps for a lot of people.

There are a lot of very basic considerations behind this little story. You remember the jingle that said:

"It takes a hundred thousand nuts to make an automobile. But the only one that wrecks the thing is the nut that holds the wheel."

Well the same thing applies in general to the airplane. The plane itself knows nothing of what's going on around it. Visibility, terrain or winds they don't bother the machine. It is sublimely unconcerned—tell it to go and it goes. It's the human pilot who is affected by conditions such as these; they limit his ability to direct the machine. And to the extent that he is capable of overcoming these obstacles, the capability of the machine to do its job is enhanced. But when the human sticks his neck into conditions with which he is not prepared to cope, then all he is doing is betraying his trust and jeopardizing his machine, as well as the job it is supposed to do.

I wonder how many disastrous flights have been preceded by the remark, "No sweat." When an accident report turns up the doleful cause factor "attempted flight beyond his capability," it would be interesting to speculate as to when the pilot first realized that was what he was doing. That he realized it sooner or later there is no doubt. But did he blissfully over-estimate his ability until it was too late, or did he knowingly stick his neck out hoping for the best? Either way it's a sad, sad story and it should never have happened.

Why do things like this happen? Why do necks continue to be stuck out? At the risk of tossing a smoking hot potato in the air, maybe our whole Air Force system may be partially at fault. The fact that all our pilots go through a standardized training program, are subject to the same minimum flying requirements and are all required to qualify for an instrument rating, may engender the impression that their capabilities are identical. This we know is not so and never will be. It is an ideal, a concept that is necessary for personnel programming purposes and little else. Statistically it's okay because things average out, but when applied to a given pilot flying a given airplane at a given time, it's entirely unrealistic and misleading. Because Joe Blow with 2000 hours and a green card can bore through a rugged weather situation and come out the other side is no guarantee that Joe Glutz, with similar experience, can do the same thing. He may well come out the bottom instead.

Take off in haste—repent at leisure. Only there's not much leisure in the gages at 10,000 feet. The best time for a pilot to get his ducks in a row and evaluate his prospects is when he has his feet firmly planted on terra firma. His airplane is sitting dormant, not using a drop of precious fuel. All the professional help is right at hand. This is the time and place for planning, for decisions. Once your airplane is off the ground and up in the murk, it's all yours, brother, your flight, your decision, your neck. Your activities upstairs are going to be pretty demanding and complex enough at best. If you find you have to compound your troubles by trying to figure things out and look things up that you ought to know already—mister, you took off too soon! And if you feel that airplane getting way ahead of you—if you're so busy trying to keep it right side up that you can't keep track of your course or position—you are "attempting flight beyond your capability" whether you like it or not.

There are always going to be some occasions when a pilot is called upon for his maximum performance, when he's going to have his hands full, in order to accomplish a mission. These times though will rarely occur in the course of an administrative cross-country flight. Nor will there be any reason on these occasions to carry passengers other than required crewmembers. Passengers may want to get home but they should not be asked to be part of a calculated risk.

Know thyself. Not how long you have been flying, or the color of your instrument card. Not as a 3-2, 2-2, 2-1 or 1-1 pilot—that's just filling in squares. Not your rank, your job or how many hours you have, or who you are. Know thyself—know your ability, right now, to accomplish this flight in this airplane. The airplane doesn't know anything about your rank or background and couldn't care less.

The weather is going to continue to do what it wants, regardless of you. You may command a thousand men, but now the issue is: How competent are you, personally, with your own hands and brain, to control this machine under these conditions? At the wheel or stick, rank vanishes. General or second balloon, it doesn't matter. It's a personal, direct relationship between human and machine. And what goes for one machine may not go for another if you're not so current in it.

You may well be the hottest smouldering boulder this side of Farmingdale in an F-84F, but you would hardly expect that to qualify you to take off IFR for Thule in a C-124, would you? Or vice versa. The same considerations may well apply to an administrative junket in a Gooney bird or B-25. The old bugaboos of habit interference and lack of currency can be just as deadly. You may be used to streaking across the top of the overcast at 600 knots plus in a jet, but how will you like lurching through the middle of the stuff in a Gooney at 140 with a load of wing and prop ice? If you stop and think, you'll know that doing a precision letdown in rough air with this old bird will be like going down a spiral staircase with two loaded B-4 bags. *Are you ready?*

Variables

We've gone a long way from the days when we could say "an airplane's an airplane. If you can fly one you can fly 'em all!" Why? There are a lot of reasons. We have variations of size from the T-34 to the B-36, variations of speed from the L-20 to the F-100, variations of complexity from the T-6 to the B-52. Aerodynamically, take a stroll through the wing of a C-124, then go shave yourself with the wing of an F-104. These things are designed for vastly different missions, have vastly different peculiarities. You can't leap blithely from one to another and keep a whole skin.

A very high-ranking officer took off in a T-33 on an administrative flight. Weather was reported as 100 feet, 1/16 of a mile. No one questions the high experience level and qualifications of this pilot, but weather like that should make anybody pause. And there are limits beyond which we cannot as yet push our equipment or our people. This flight was no exception. It ended in a fatal crash seconds after takeoff. Remember the little boys who had the contest to see who could lean out the window the farthest? One

This is the time and place for planning, for decisions. Once you're off the ground, in the murk, it's all yours.

We have come a long way since the days of "an airplane's an airplane." We have variations from the F-104 to the huge B-36 and C-124. If you fly one, can you fly them all?

fell out—he won. Aren't we doing the same thing when we try to push a good thing too far?

During and immediately after our last two wars, recurring newspaper headlines kept reminding us of the fallibility of our combat heroes. Time after time aces would return from their glorious combat tours and were killed on some inconsequential flight in the ZI. Buzz Wagner, Bong, Baker, McConnell—the list is impressive. No criticism of these men is implied. The point is that no matter how good you are, no matter who you are or how hot, the aircraft can still getcha if you don't watch out! If you drop your guard you are vulnerable — every time. Or more pertinently, if you overestimate your potential you can be in for a rude shock when the roof falls in.

One of the Air Force's most ludicrous accidents bears eloquent testimony to just how weak we mortals be. An L-20 took off in the wee small hours one morning from somewhere in central Texas, heading west. A couple of hours later the aircraft and the ground met, somewhere in West Texas. It developed, as you might suspect, that both pilots were snoozing, concurrently, and the ground elevation gradually caught up with them. Fortunately they survived, but imagine how you would feel trying to think up a convincing story for the board after a lulu like this one.

Before you laugh, ask yourself how many times you have gone leaping off in the dusk after a full day of work, to get your night time on some nice long administrative cross-country? How often has this involved instrument flight, and how often has it been conducted in the wild and wooly West where you sit for hours at nine or ten thousand feet, maybe without oxygen? Worse yet, how often have you ordered some willing young Second John off on just such a mission?

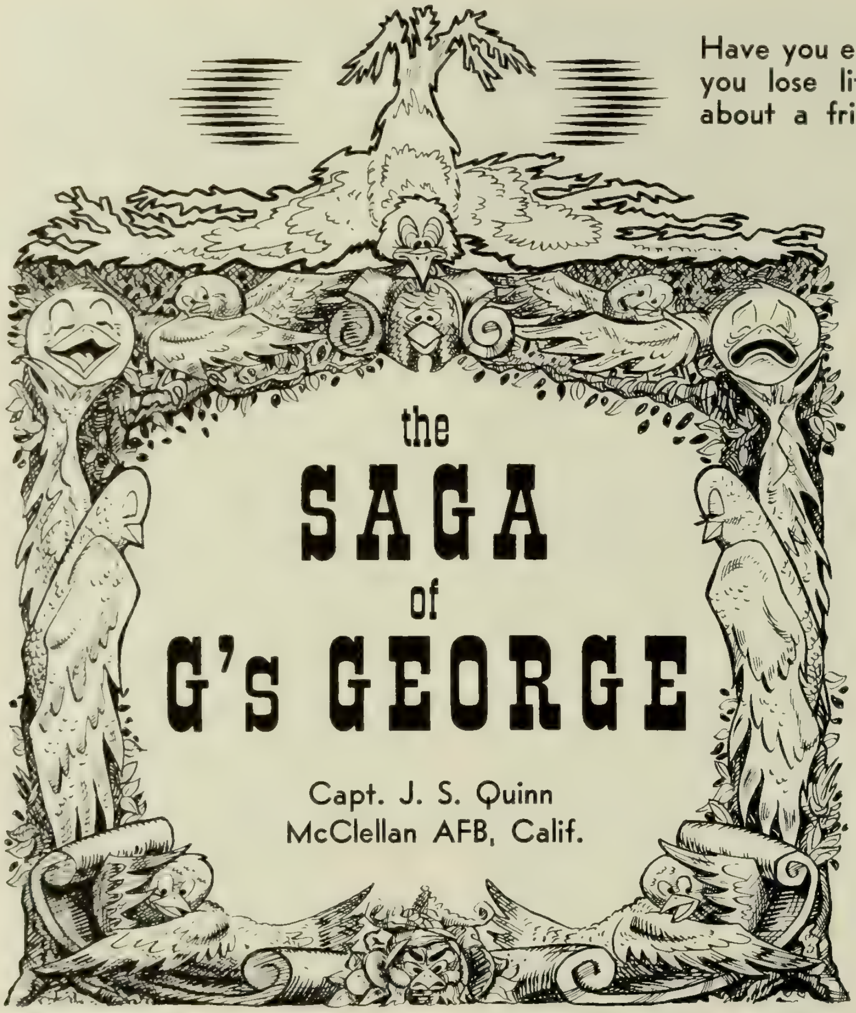
Sure we have operational missions that are long and demanding. But unless we have rocks in our heads, we plan for and take adequate rest before such flights. Proper crew rest is provided for when these missions are laid on. If it isn't we're just begging for trouble. It's on the non-scheduled administrative and proficiency type flights that we commit the greatest abuses. It's easy to forget that a man gets just as tired flying a B-25 as he does a B-47, maybe more so. Certainly if the airlines demanded that a pilot push a slow airplane all the way through from coast to coast after a full day at the office, the pilot's union would have something to say about it. A commander with sense would never demand it, so why should Joe Pilot demand it of himself?

When a pilot pushes his physical limitations unnecessarily he is not proving his manhood, his courage or his ability. All he is proving is that he is not using good sense. The Good Book points out that no man just by taking thought can add to his stature one cubit. By the same token he can't add one foot to his altitude tolerance, one hour to his capacity for going without sleep. All his brave intentions won't silence the querulous growls from his hungry stomach. All the thought in the world won't brighten his night vision, dimmed by lack of sufficient oxygen. Pride won't do much to speed up reflexes that are dulled by lack of sleep or nourishment. Let's face it—the mind of man is a noble creation but it is still hitched to a body that's part animal and part vegetable. A damaged container doesn't hold water very well. Even a Rolls Royce doesn't perform at its best on four flat tires. That physique of yours may be only a dollar's worth of chemicals, but it's hard to replace. You're going to need it if you intend to be around for a while, so why abuse it?

So, know thyself. Know the limitations that are inherent in a human being — beyond which you cannot push yourself. Know the particular physical limitations and tolerances that apply to you as an individual. If you can correct them or improve on yourself, for gosh sakes do it. Finally, know the limitations of your ability, the limitations imposed by your state of training, and do all you can to upgrade yourself.

When you know yourself you need never be guilty of going as a boy on a man's errand. You can allow the job to grow with you, not ahead of you. And PFC Snodgrass and Seaman Hawser can relax in the knowledge that whatever the decision, they will be in good hands. ●

Have you ever stopped to consider exactly why you lose lift in a turn? Here is an article about a friend of ours who spun-in and why.



the SAGA of G's GEORGE

Capt. J. S. Quinn
McClellan AFB, Calif.

ONE VERY WET and sloppy Maryland morning a few years ago, I fell heir to a well-doused dove. With soaked and sagging feathers, his lift weakened by the weather, on the ragged edge of stall, he staggered in. And there he sat, grounded, soaking in a puddle on the patio, until I rescued him.

George, that was the bird's name, was suffering not only from the water. He was suffering from a sorely wounded vanity. George had always considered himself an exceptionally skillful pilot. So skillful, in fact, that he enjoyed comparing himself with human pilots. That was because he generally came out best. And George's favorite comparison was in the tight turn department.

George couldn't remember all the times he'd seen humans crash because they'd tried to "rack it in" a little too tight on final. And the times he's seen them spin, snap or stall out of a steep turn were without number. But he—George (*G's* George, some of the admiring birds called him)—had *never* stalled.

Now what would the birds say? Now he was no better than a human. His point of pride was gone. The worst had happened. "G's" George had stalled in. At least that's what everyone would claim.

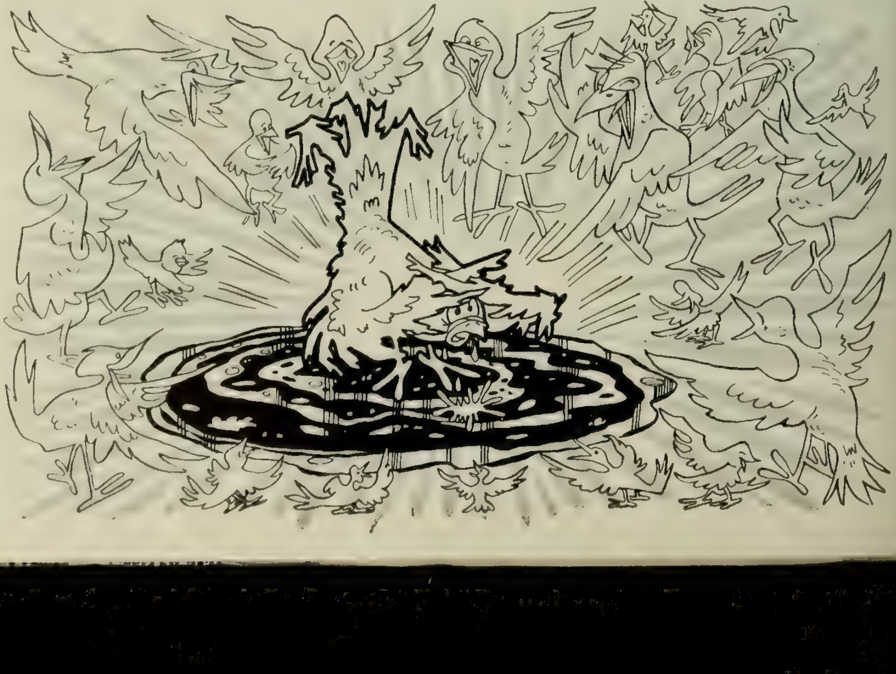
George was a skillful pilot and knew it. He could land on a spot, touching down as gently as one of his downy underfeathers. He could climb and descend at very steep angles. And his turns were something to see. There were those who claimed he didn't turn, he rotated on a wingtip. But the thing that made George so proud of those turns was that he'd never stalled.

It was this all too human tendency to take all the credit to himself that caused George to ignore aerodynamics. What did a pilot like him need that stuff for? He actually put some faith in the claim made by some, that he could fly the egg he came in. But it was aerodynamic ignorance, more than anything else, that was responsible for his sad plight.

Poor, pathetic George, however, had been treated more kindly by fate than he had realized. Soaked and saddened, his vanity for the moment stilled, George was ready and eager to learn. Gratis, he had been granted the virtue of humility, the key to the doors of wisdom.

He found that aerodynamics wasn't nearly as mysterious as he'd always believed. In fact, he was able to work out the entire equation for lift with very little help. He knew from his flying experience that altitude air density affected lift. (He discovered that the engineers called this factor "rho"-ρ). The next thing that came to mind was airspeed—V. It was obvious at a glance that increased velocity meant

He had "spun-in." Would other birds say, "He's no better than humans?"



increased lift. It took a little thought, however, and a little help, to understand that lift varied as the square of the velocity.

Then George thought of a number of inter-related things, all of which have a very definite effect on lift. He found that this complex of variables could be divided into the simple process of adding area to his wing-stand, the more complicated shape-changing and airflow control of which he was capable. But even this was simplified when he realized that all these complex controls did was to change the relative distribution of pressures above and below the wing. This, then, was the factor referred to as coefficient of lift—C_L. This is George's formula:

$$L = \tfrac{1}{2}\rho V^2 S C_L.$$

He could climb and descend at steep angles. His turns and banks were something to see.

With the help of his lift formula, George soon discovered why his lift hadn't been equal to his weight.

First of all, the water had soaked his large wing feathers. This made the effective wing area (S) smaller. Also, it made them ineffective in their low speed, high lift, function as flaps and as boundary layer control devices. All of this restricted his speed (V), but more importantly it had increased his stall speed. The lift required had gone up too by the weight of the water he'd taken aboard. But George regarded this weight factor as insignificant compared with the effective increases in weight he was used to in his extremely high-G turns.

George was beginning to realize that his ability to make those high-G turns couldn't be credited solely to his skill as a pilot. In a large measure those tight turns had been built into him. And he realized with chagrin that he had misjudged his human counterparts. They didn't lack skill. They just didn't have the control available that he did.

How much more he had to call on than they, especially at critical speeds. First of all, he was an ornithopter (wing-flapper), and that paid off big at very low speeds. In addition, if high lift were called for, he could extend his wings and grab more air. And he had many other "specials" that hadn't yet been worked into practical airplanes. Then the light came on, and George realized why so many human pilots had killed themselves in tight turns at low speeds. Since he doesn't write, George made me promise to pass the word along to you.

The essence of George's formula, for practical purposes, states that with a constant angle of attack, lift available varies as the *square* of the velocity. Thus, if 150 knots are required to sustain 2G flight, then 300 knots would be required to sustain 8G level flight.

In memory of George, knowing he would wish us to go "whole hog" in presenting this information, we shall look into the effect of angle of bank on G forces. Thus, we will be able to see at a glance the effect of *bank* on minimum *speed* required to sustain level flight—stall speed.

Bank angles up to 60 degrees create little problem in most aircraft. At this angle the G forces have only doubled, putting little stress on the airframe. The stall speed has increased only 40 per cent, a relatively safe speed under nearly all conditions of flight. The only rub is that anything over 60 degrees rapidly gets worse, both from the standpoint of G required and stall speed. In order to illustrate this as simply as possible and to make the relationships readily apparent, they are charted.

Bank Angle	Effective Weight	Stall Speed
0	1G	100 kts
45°	1.4G	120 kts
60°	2G	140 kts
70°	2.9G	170 kts
75½°	4G	200 kts
80½°	6G	246 kts
83½°	9G	300 kts
85°	11.5G	340 kts

He said that he could fly the egg he came in. Why should he bother with aerodynamics?

We hope that this is as clear to you as it was to "G's" George. He certainly had your interest at heart.

We had to shut the windows and lock George out. He probably still doesn't know why. But for many days thereafter, my roommate could be heard muttering unkind things about George as he looked at a spot on his girl friend's picture. ●

"CASEY" GOES JET

R. L. "Dix" Loesch

Senior Test Pilot, Boeing Airplane Co.

It won't be long until the tankers will be roaming the wild blue area that was once reserved for the fighter and bomber boys.

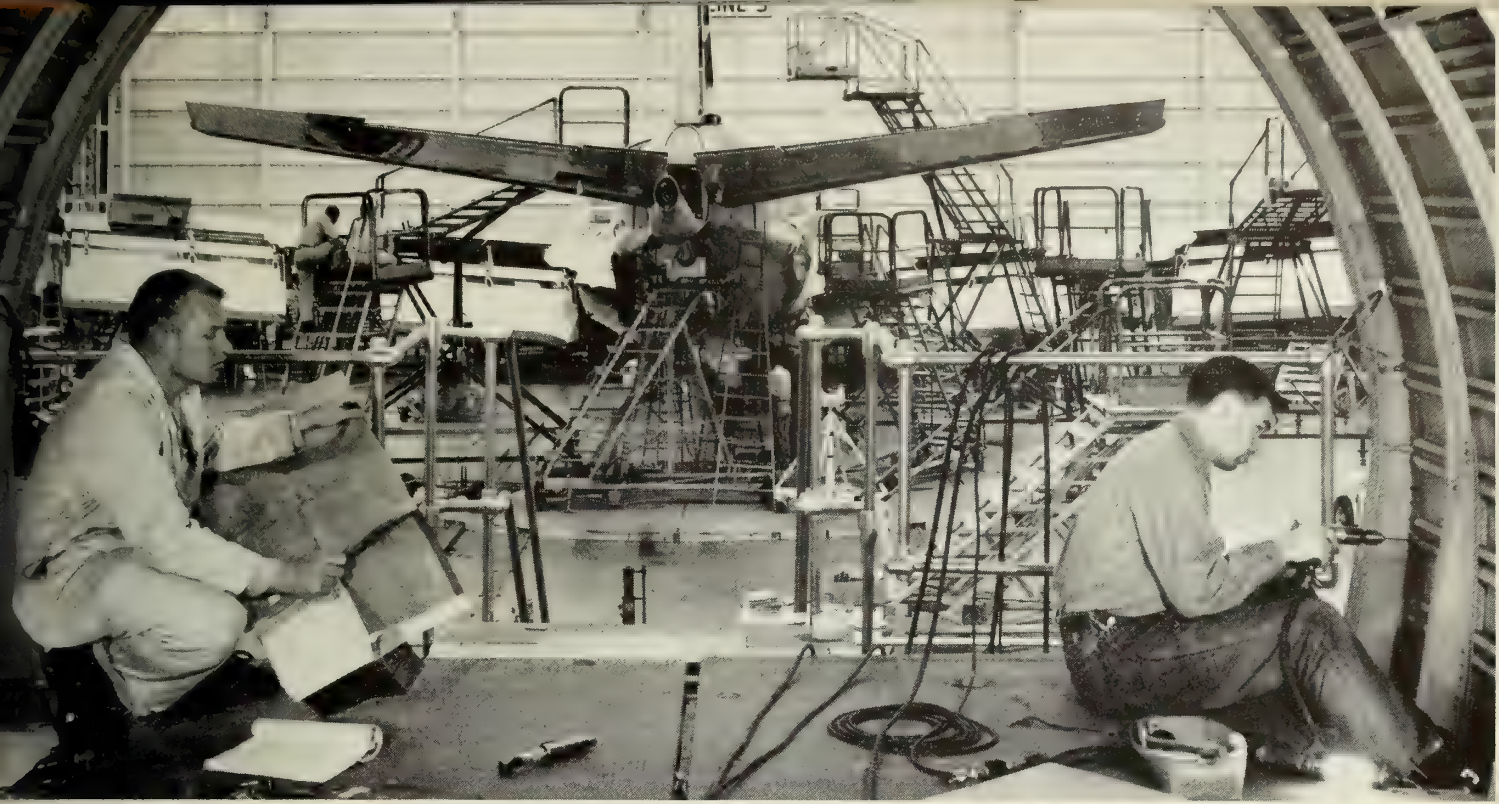
IN A FEW months, the Boeing KC-135 jet tanker-transports will be entering service with the United States Air Force and a good many of the pilots who read FLYING SAFETY regularly will be assigned to these new birds. This is being written to describe some of the characteristics of the KC-135.

This big, four-jet transport type has just made its maiden flight, while the Boeing 707 prototype, from which the KC-135 was developed, has been flying for two years and has logged over 500 hours; and the earmarks of the prototype, with improvements in some areas, will be found in the production tanker-transports. Thus, the 385 hours I've logged in the prototype have given me a good idea of the performance and handling characteristics of the '135s.

Pilots who have been flying transports should find it simple to convert to the '135. The jet tanker-transports will be similar to present-day transports and tankers in handling, with the new airplane having the advantages. It will have excellent stability and control, and generally speaking, control response will be better than you have with today's transports.

The primary controls are all manually operated, internally balanced and tab-controlled. The pilot can check the ailerons, elevators and rudder on the ground for freedom of movement of both the tab and control surface because additional control column or rudder movement at the end of the tab travel moves the entire surface. Also, it's nice to know that there are no gust locks to worry about on this airplane. In place of gust locks there are built-in gust dampers.

The lateral control is a little unusual in comparison with present transports. There are two sets of ailerons, an outboard set which only operates when flaps are down and an in-



Shown here is the first KC-135. Earmarks of the prototype will be found in production model.

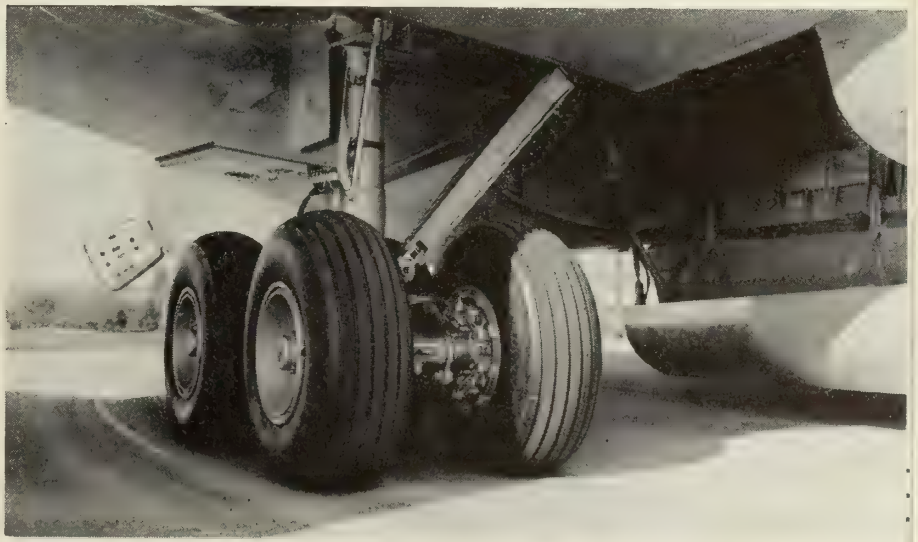
board set which operates at all speeds. The ailerons are assisted by wing spoilers on the upper surface which are activated by hydraulic pressure and which are very effective at high speeds and Mach numbers where a wing with ailerons only tends to lose control. These spoilers retain their effectiveness right down to the stalling speed of the aircraft. The spoilers are also effective speed brakes. Using spoilers as speed brakes in conjunction with the landing gear, which can be used at up to 320 knots, indicated descent rates as high as 18,000 feet per minute are possible.

Pilots will find the cockpit well laid out. It is much simpler than that of the usual four-engine transport of today, due to the jet engines. They don't require propeller pitch controls, feathering buttons, manifold pressure gages and other instruments and controls peculiar to piston-engines. Visibility from the cockpit is excellent.

As with other jet aircraft, the KC-135 can be almost entirely checked for flight before starting the engines and takeoff can be made immediately after a power check on the runway.

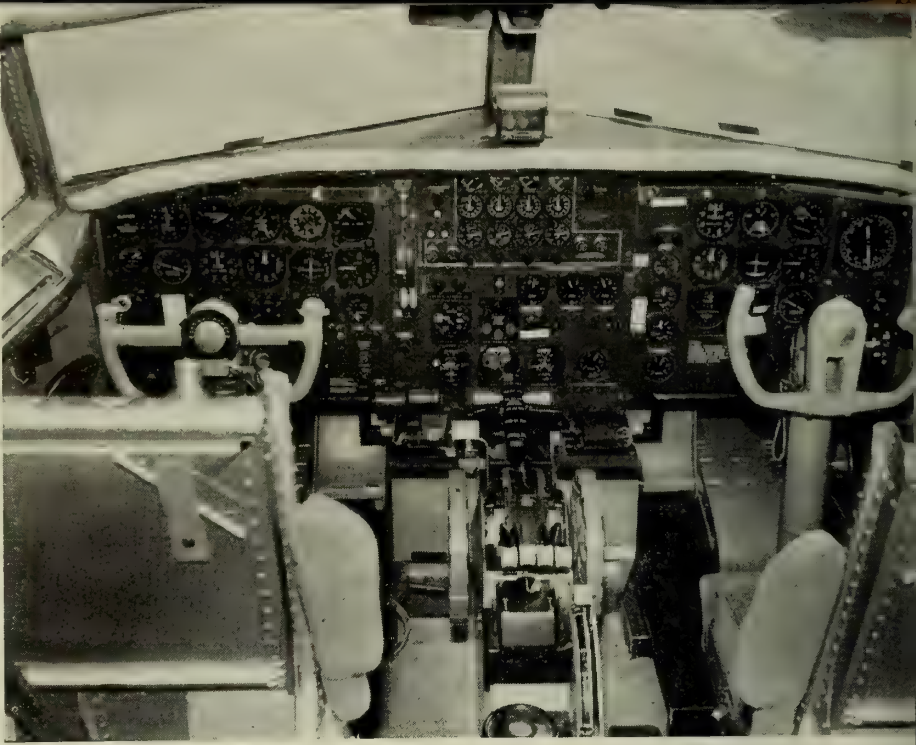
The airplane has conventional tricycle gear, with the main gear made up of four-wheel bogies. The turning radius is a little greater than with airplanes which have dual-wheel gear because excessive scrubbing and high torque loads would occur on the inside gear if it was used as a pivot. The main gear is a little closer to

Above, KC-135 takes to air on one of early flights in long series of test flights. Below, turning radius is a little greater than with planes having dual-wheel gear because of the excessive scrubbing and high torque loads which would occur on inside gear if used as a pivot.



Above, both entry and escape exit is shown. The door swings out to provide wind screen.

Above, is dual-tire nose gear installation. Below, is a shot of flight test personnel.



Pilots will find the cockpit much simpler than that of the usual four-engine transport of today. This is due in part to the jet engines. The rest results from concerted efforts of designers.

the center of gravity than most transports, and the nose can be lifted off at a speed considerably under normal takeoff speed. The best and safest technique is to leave the nosewheel on the runway until about five knots below takeoff speed, otherwise the airplane will take a little longer to get airborne.

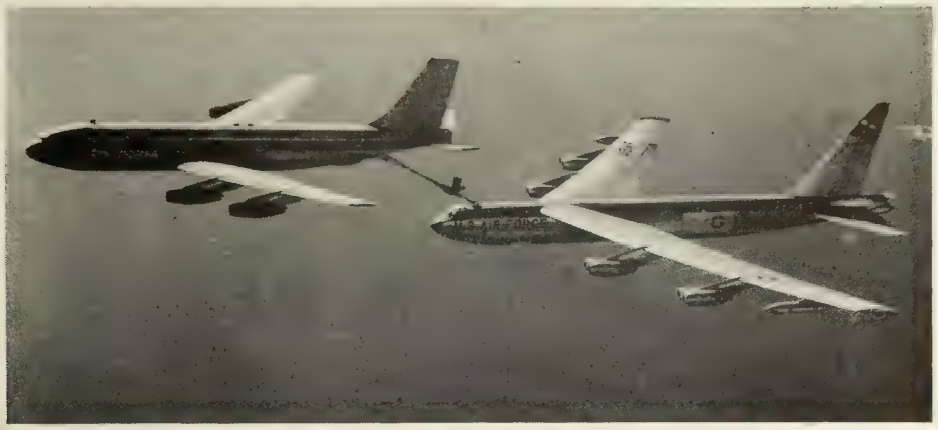
The fore-and-aft trimming on the KC-135 will be done by varying the angle of incidence of the horizontal stabilizer, just as on the prototype. The stabilizer is trimmed by means of an "up" or "down" button on the control wheel. A manual trim wheel on the pedestal can be used to drive the stabilizer in the event the motor system fails. Before takeoff, the stabilizer should be set so that only a small pull force is needed to lift off at takeoff speed. Elevator effectiveness is high enough and forces are low enough such that the airplane can be flown off with almost any setting of the stabilizer. It definitely is less critical than most present-day transports. Once you are off and climbing, or cruising, the pitch trim by the adjustable stabilizer is highly effective at all speeds and the control column is in the same position with the center of gravity at any point. At high Mach numbers, trim remains effective.

Most transport pilots are flying airplanes which do not have the capability of exceeding IAS limits. This is not true of a jet transport which can easily exceed placard speeds at low altitudes. Pilots will need to be alert regarding this until they have acquired a feel for power settings and for the sound and vibration build-up which occurs at higher speeds.

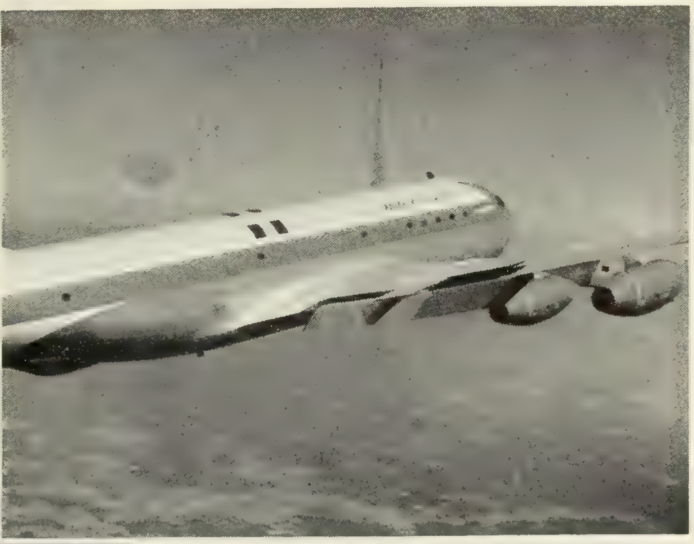
The KC-135 will have nearly two and a half times as good lateral control as the KC-97. Its directional control will be effective enough to handle an outboard engine failure at speeds *below* takeoff speed except at very light weights. In normal flight the KC-135 will be a "one-hand" airplane. Yet stick force per G is high enough to prevent the pilot from accidentally loading the airplane beyond its limits.

Although higher fuel consumption rates are apparent, the attention required to the ground miles versus fuel consumed should not increase since cruising speeds are so much higher and tend to minimize variables such as wind and temperature.

We have done complete stalls in the 707 prototype with the airplane in all configurations and with the stick all the way back. The airplane has nearly perfect stalling characteristics. There is small tendency to roll, and any roll can be counteracted by the lateral control which remains effective throughout the stall. As you approach the stall, buffeting begins 12 to 16 per cent above the stall speed and increases as the stall is approached. You can't mistake it. Then the nose falls straight through the horizon. Absence of propeller slipstream causes power off and power



For high-speed, inflight refueling the KC-135 carries a special boom.



Here is a takeoff and inflight shot of the prototype.

on stalling speeds to be virtually the same.

Letdown can be controlled by means of the spoilers, used as speed brakes. On the approach, if you are above the ILS glide path or desired approach path, you can apply speed brakes to descend to it. In the pattern, and on the approach, the '135 will be able to stay behind today's airplanes. Its speed, while about 600 mph for high-speed cruising, will be only 125 knots during the final at normal landing weights.

Approach is a little more nose-high than in present-day transport and tanker aircraft, but visibility is excellent and there is no difficulty in judging clearance over obstacles or height above the runway. It's a good idea to keep the airplane trimmed hands-off during final approach, rather than with the slight nose-down trim used in some airplanes. Once on the ground, getting the nosewheel down early and raising the speed brakes will greatly aid in minimizing ground roll. Ninety per cent of the weight of the airplane is on the main gear at landing speeds after the nose gear is on and the speed brakes are raised.

A hundred pilots have already flown the prototype. Even those without any previous knowledge of the airplane, or of jet airplanes of any kind, have experienced no difficulty in making successful takeoffs and landings. None of the differences between the KC-135 and present-day transports should be of any real concern. The *general simplicity of operation* will, by far, be the biggest difference encountered and bears out the old maxim that progress marches from the complex to the simple.

If pilot enthusiasm, as far as the prototype is concerned, is a guide for acceptance of the '135, then it should be one of the best liked airplanes in the Air Force. I would predict that any difficulty that arises will not be in getting pilots in the KC-135s but in keeping them out. ●

The "Down to Earth" Approach

John Radick, ACIC

The pilots handbook is undergoing a face-lifting. Gone are the days of wrestling with a large bulging folder. The new book, for both jet and conventional, will be pint-sized and easy to handle.

ONE OF OUR many good instrument pilots was completing a four-hour flight from McGuire Air Force Base, New Jersey, to Lambert Field. St. Louis. The weather was foul—normal IFR conditions. Vibration and turbulence made control of Joe's Gooney bird difficult. He was sweating some, even though it was cold in the cockpit.

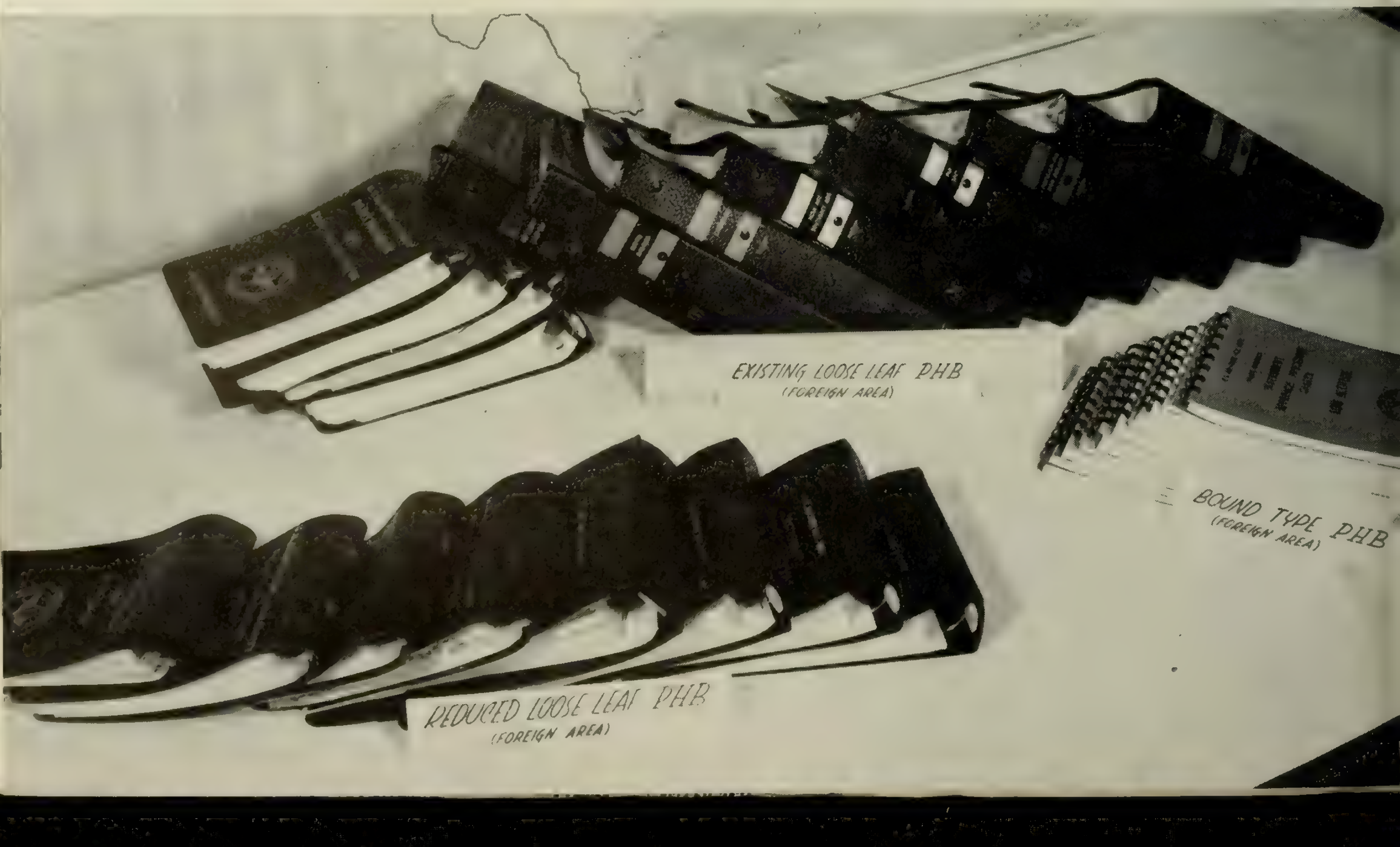
"Air Force 19409, this is St. Louis control. Maintain 3000 feet, hold on Spanish Lake fan marker until further advised. Expected approach time is 43." The voice of the controller came through reasonably clear.

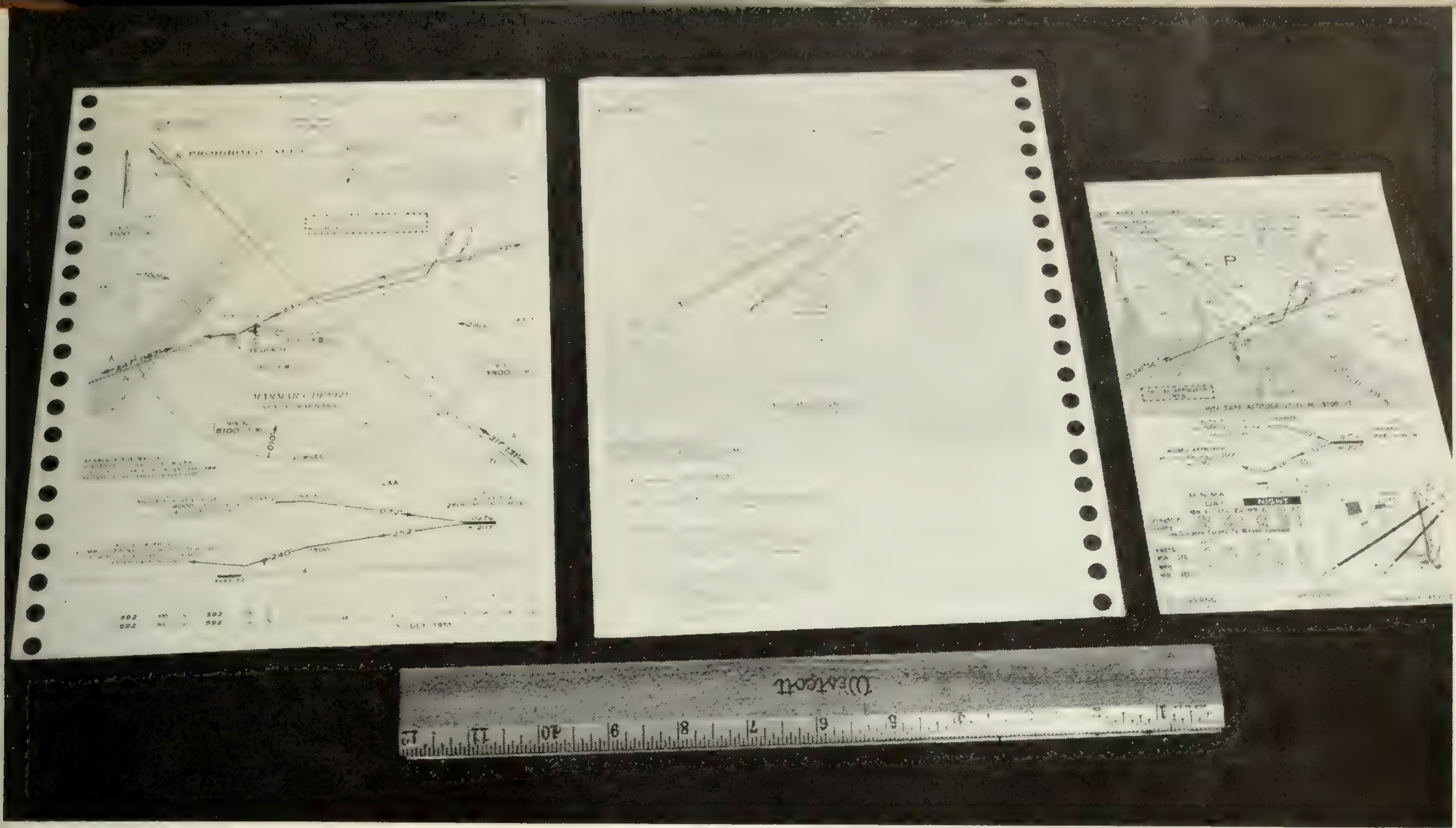
"Air Force fow-er zero nin-er," Joe acknowledged St. Louis' instructions, glancing at his Radio Facility Chart to check the holding pattern at Spanish Lake. Three minutes later they were over Spanish Lake fan marker and started the tedious task of holding. Maybe the delay in landing wouldn't be too great. "Let me have another look at the letdown, Bill," he shouted to his copilot.

Bill reached down beside his seat and brought up two large bulky Pilots Handbooks he had been saving for rainy days. "Let's see," he thought to himself, "since the ceiling is reported at 500 feet, we may have to use ILS."

He opened the East United States book to the Lambert St. Louis letdown sheet and held the bulky volume across one knee. Then he opened the ILS book, making a grab at the other book as it began to slip from his lap. He muttered a few well-chosen words which were lost to posterity in the noise of the engines.

The two types of books in foreground are being tested to determine which one is acceptable.





Shown, above and below, are comparisons of sizes. Note that the airfield layout and letdown procedures are both portrayed on one side of chart.

NORTH ATLANTIC and EAST CANADA
LOW ALTITUDE
NORTH ATLANTIC AND EAST CANADA

"Look at this, Joe. Did you ever see such unnecessary bulk?" He ripped the range procedure from the Handbook and stuck it on the panel while he continued his question. "And why the devil does all this information appear on an instrument approach chart? We only need the procedure and required altitudes."

"Beats me," Joe replied, already fully occupied with his own problems.

Many Complaints

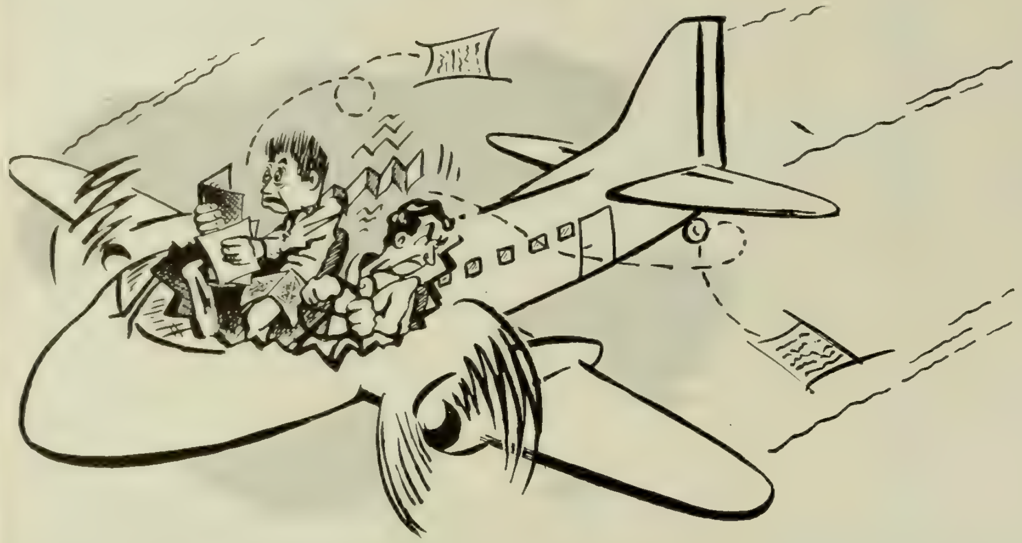
These have been common complaints of pilots in the Air Force for some time, but complaints that we hope won't continue. Not that Joe and Bill didn't get down from the Spanish Lake fan marker. We wouldn't have you think they clobbered themselves just because of a bulky Handbook.

The Future

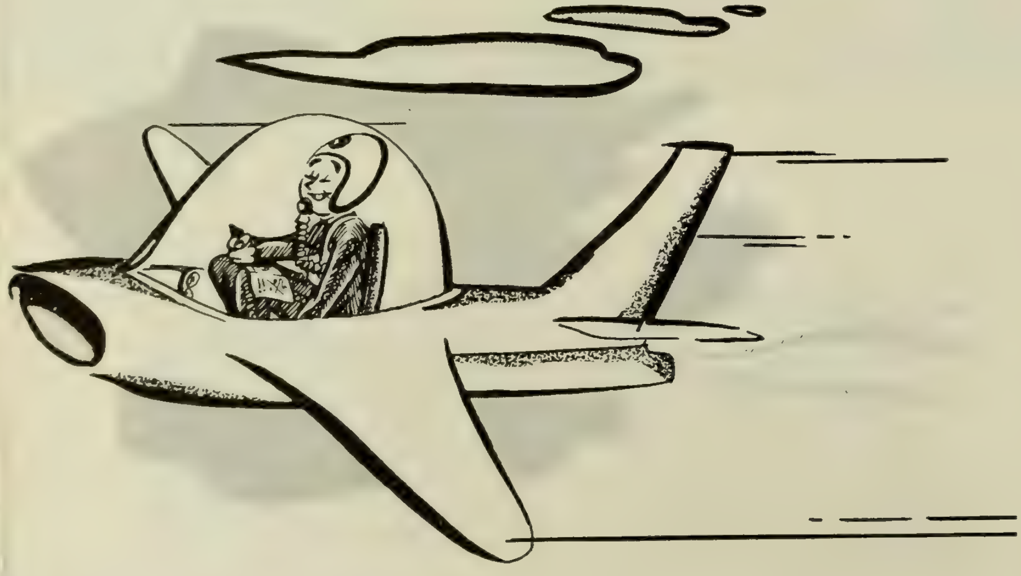
With these complaints in mind, let's see what the future holds for pilots like Joe and Bill. Bill's main complaints were about the bulk and unnecessary detail on the charts.

Through the aid of one slightly used crystal ball, we can see that Pilots Handbooks of 1957 won't be so big—about 5 x 8 inches. That's a far cry from the 8 x 10½ job which Bill fumbled around with, as obsolete as the aircraft it was designed for. This new size binder will be combined with an improved, simpler instrument approach procedure chart, designed along functional lines.

Let's take a look at Joe in base ops after the new Pilots Handbook is operational. Picking up materials to use in flight, he looks for a Pilots Handbook. He will find the terms "low altitude" or "high altitude" procedures used instead of "standard" and "jet." These new terms are based on normal altitudes associated with the initial phase of an instrument approach. Conventional aircraft will normally be expected to use the "low altitude" procedure, while jet aircraft that make initial penetrations from 20,000 feet or above, will follow the "high altitude" procedure.



With the new letdown book, Joe Pilot is less weighted down with bulky aeronautical publications.



Joe, still driving a Gooney, will want the "low altitude" book. When he looks inside, he'll find a much simpler instrument approach procedure. Complete information will be on one side of the sheet, including the aerodrome diagram. No more flipping of pages while in the landing pattern. And, if there is more than one procedure to choose from, it will be found on the opposite side of the sheet or on adjacent pages.

Other Features

Joe once again is airborne, but less weighted down with bulky aeronautical publications, and when the time comes for his transition to jets, he'll find his Pilots Handbook easier to use despite additional flight gear required for jet flying. (See the July issue of FLYING SAFETY for changes to Radio Fac Charts.)

Only an outline of the instrument approach will be shown, together with related bearings and altitudes. No need to show obstructions along the procedure track, since the procedure allows sufficient clearance as long as prescribed altitudes are maintained. Joe shouldn't have to add an extra thousand feet for the wife and a few for the kids. We believe that even limited cultural information, such as a few trees and telephone poles, may encourage Joe to deviate from good practice. What is good practice? To use the established letdown as an IFR procedure and not a combination of an instrument and visual technique.

In the box at the lower left portion of the chart, Joe will find all visibility and minimum altitude requirements. Air Force Regulations 55-24 and 60-16 may be referred to for more information on current USAF policy and the lowest minimums permissible for operations.

If Joe is going into an unfamiliar field and he wants to refer to a sketch prior to landing, the aerodrome is "laid out" on the lower right portion of the chart. Some pilots say you need an outline of the aerodrome, others say you don't. Nevertheless, to provide information needed for landing, this diagram does show the runways, the associated taxiways, approach lighting and critical obstructions around the aerodrome.

One more time Joe has made a safe instrument approach and landing, only this time without juggling a cockpit full of bulky publications.

More Facts

You may be wondering why the small size charts (5 x 8½) you now receive are printed on 8 x 10½ pages. This is the first step in converting the Pilots Handbook to the new format. We have to revise all existing charts to the new format before the smaller size binders may be issued. Conversion should be completed and charts issued in the smaller size during the early part of 1957.

In the meantime, some question exists as to the type of binder that will best suit the needs of the user. Some have requested that we retain the loose-leaf principle while others have indicated a preference for a bound type Pilots Handbook.

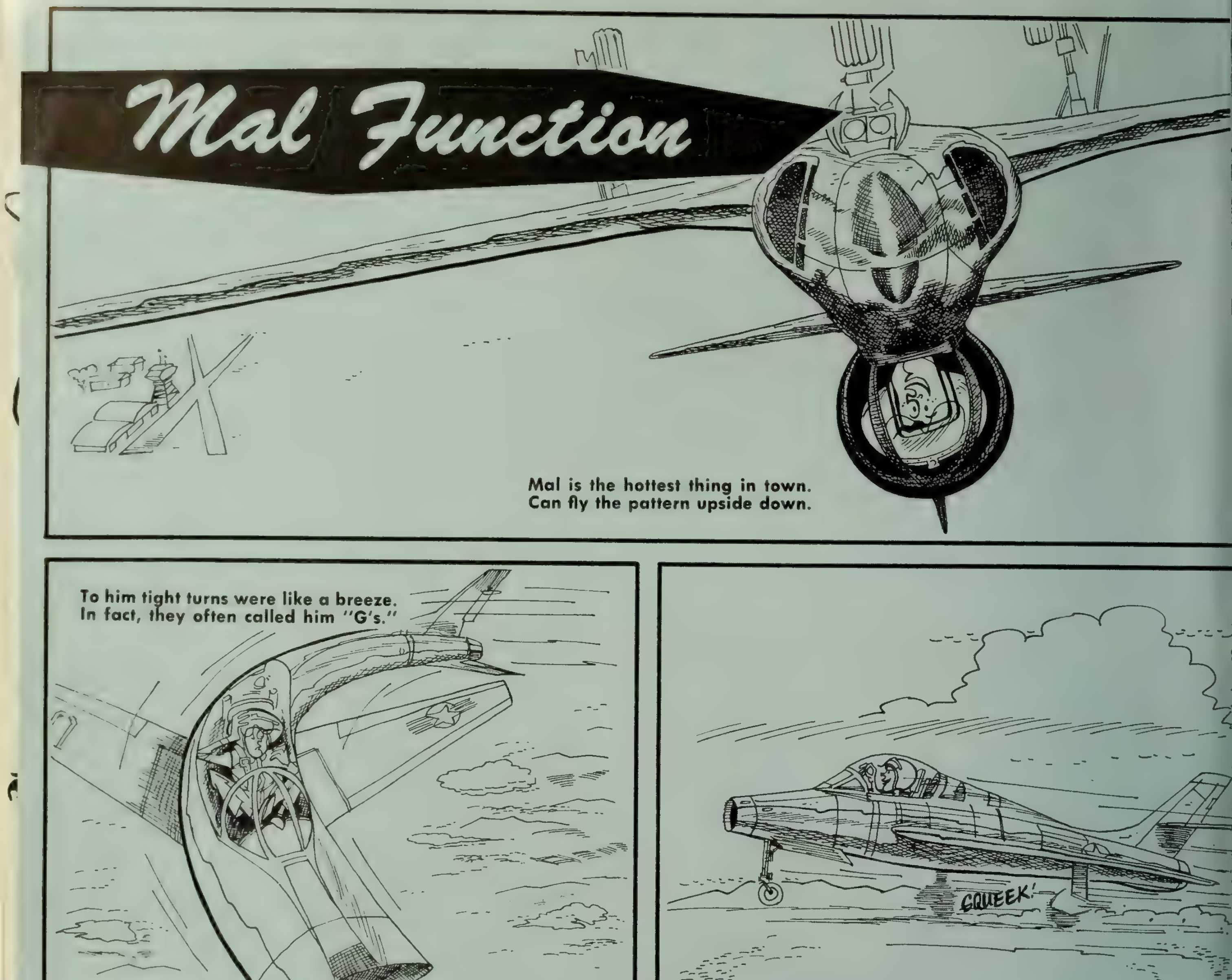
Preliminary plans call for issuance of the new small loose-leaf book for use in the FEAF and USAFE areas during the latter part of 1956. During the same period, both the loose-leaf and bound type Pilots Handbook will be issued in the FEAF area. Headquarters USAF has authorized the issuance of the two types in this area for a period of six months in order that both methods may be thoroughly tested and evaluated. You should know the results early in 1957. Issuance of one of the two types of binders will be Air Force-wide.

Regardless of the aircraft type or mission, the new Pilots Handbook should make getting "Down to Earth" an easier process. ●

Predictable!

How successfully could you predict
The whims of this little doll? More
Important, what are the odds on
Successfully forecasting the moods
Of another gal, Mother Nature? Catch
The story on page 4 and contemplate
Your chances when you place too
Much store in a weather forecast.

Mal Function



Mal is the hottest thing in town.
Can fly the pattern upside down.

To him tight turns were like a breeze.
In fact, they often called him "G's."

His landings were a thing to see.
He always touched down perfectly.

But he forgot this balmy day.
The formula that tries to say . . .

At low airspeeds with bank increase.
For man and bird, does flying cease.

*U. S. GOVERNMENT PRINTING OFFICE . . . 402035

629.1305
FLYS

FLYING SAFETY

UNITED STATES AIR FORCE

NOVEMBER
1956

THE LIBRARY OF THE
NOV 26 1956
UNIVERSITY OF ILLINOIS

The F-104 Story . . . . page 10

File Thirteen

. . . This month our cover shows the XF-104. Incidentally, if you have been led to believe this bird is more missile than airplane you have been misinformed. . . . Headquarters AMC, ARDC and WADC are receiving numerous unsigned recommendations by well-meaning troops who are seriously trying to improve Air Force equipment. This isn't the way to get the job done. The correct method is set forth in AFR 66-30 and T.O. 00-35D-54. The procedure is to submit recommendations through the USAF Product Improvement Program (PIP). The channels exist, so use them. They are the shortest route. . . . The other day I land my T-Bird only to find a notice to call the Ops officer. This I do, and he says, "We have had a report of a jet buzzing a hospital, downtown. Where were you at 0950?" Fortunately, I was somewhere in the GCA pattern at the time, however, the point is not so much who as why? Why would anybody roar around at extremely low altitudes any place, much less over a populated area? With our new noise makers, expanding facilities and growing communities, we have enough trouble keeping peace on the home front without some knucklehead noising up the area. There are many, many reasons for not flying dangerously low.

1. Gets folks mad at the Air Force.
2. 'Tain't safe.
3. I may not be able to prove where I was at that time.

'Nuff said.

Perry J. Dahl

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Please send Flying Safety Magazine for one year to the following address. Enclosed is a check or Money Order for $2.50. ($3.50 for foreign mailing.)

Name

Address

City......................State..........

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major V. R. Stutts

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby
T/Sgt. Chester McCubbin
T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune
A/1C Al Fagerwick
T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

Baby, It's Cold . . . INSIDE 4
When the Whistle Blows 7
Parade of the Centuries 10
Recognition of Error 16
"Tai fung" Chasers 20
Keep Kurrent 25
Chart Chatter 26
Dead Man's Curve. 28

VOLUME TWELVE NUMBER ELEVEN

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

FLIGHT SAFETY ★ AWARDS ★

Fourteen coveted FLYING SAFETY PLAQUES have been awarded for the period 1 January through 30 June, 1956. The recipient organizations, listed on the following two pages, stand as symbols of increased economy and effectiveness through accident prevention.

The exceptionally commendable accident records of these units reflect the uncompromising efforts of each officer and airman. Only through utilizing and implementing sound accident prevention practices and the display of exemplary airmanship can such achievements be attained.

The following pages list the units by major command. A brief narrative of the missions performed and hazardous circumstances encountered substantiate their claim to "top honors" in the field of flying safety.

3594th CCT Sq
Nellis AFB, Nevada
Air Training Command
F-100

A new. ***super-sonic aircraft*** was introduced. Instructors had very ***limited experience*** in the F-100. The experience level of the students was as low as 350 hours total flying time. Pilots with ***no previous F-100 time*** performed the transition, formation, gunnery and tactics.

★ ★ ★

464th Troop Carrier Gp. (Med)
Pope AFB, South Carolina
Tactical Air Command
C-119

During this "accident free" period ***319 tons*** were airlifted, ***175 tons*** dropped, ***10,713 personnel*** dropped and ***11,957 personnel*** airlifted. The airfield was under ***major construction,*** necessitating the utmost caution. Field maneuvers were performed involving mobility capability tests under simulated combat conditions.

★ ★ ★

6614th Air Transport Gp. (Med)
Pepperrell AFB, Newfoundland
Northeast Air Command
C-54 — C-119 — H-21

There were no accidents or incidents while performing such missions as helicopter supplying to the remote ***DEW Line*** and AC&W sites; ***ski-equipped*** cargo aircraft operating in ***uncharted areas*** and POL airdrops on the ***Greenland Ice Cap.*** In addition, support was given the Royal Canadian Mounted Police and the Danish agencies during emergencies.

3525th CCT Wg
Williams AFB, Arizona
Air Training Command
F-86F — T-33

The Wing compiled a total of ***37,545 flying hours*** during the award period. The mission of the wing was changed to the F-86F aircraft requiring ***up-grading*** of all instructors. MDAP students from nine different foreign countries contributed to training difficulties due to the language barrier.

★ ★ ★

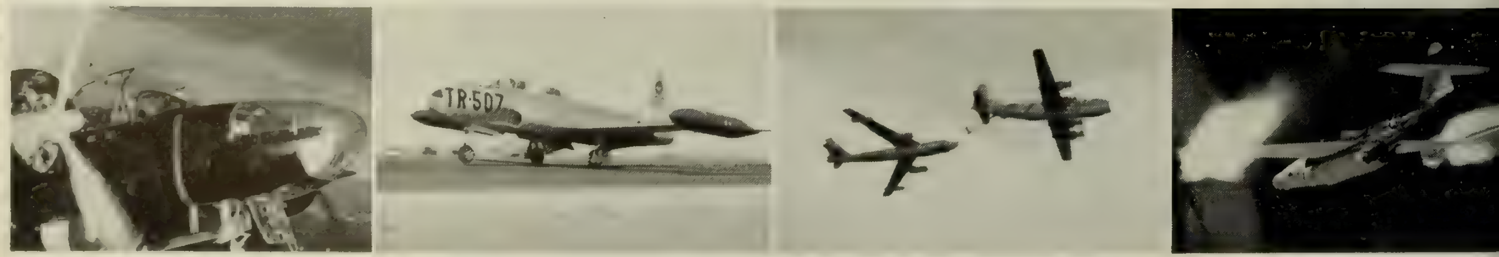
43rd Bombardment Wing
Davis-Monthan AFB, Ariz.
Strategic Air Command
B-47 — KC-97

Over 13,000 hours were flown for this period without a major or minor accident. Missions included ***aerial refuelings*** during the hours of darkness, while maintaining radio silence and with formations intact. Extensive ***airfield construction*** required extreme caution during aircraft ground movements.

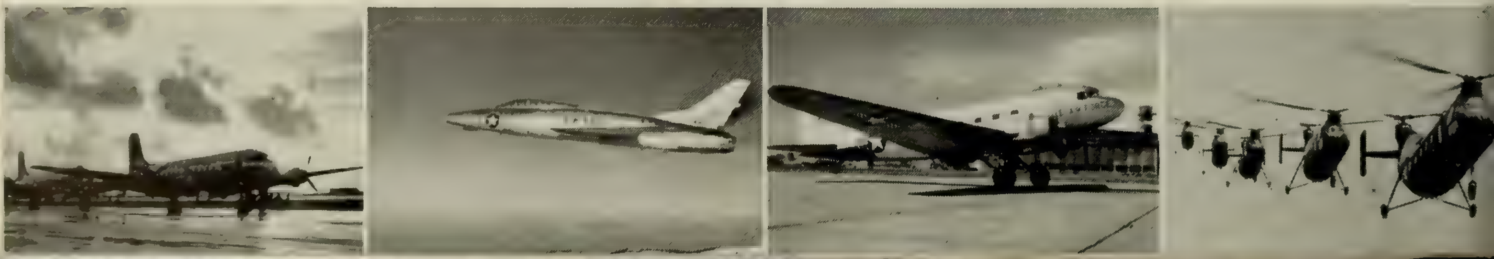
★ ★ ★

3rd Air Rescue Group
Nagoya Air Station, Japan
Military Air Transport Service
SA-16 — SH-19 — SC-47

The speed with which rescue aircraft must be dispatched ***prohibits adequate preflight*** planning. Many missions were flown over ***hazardous terrain*** without navaids. Missions included over-water flights and tricky ***open-sea landings*** as well as low level search over mountainous terrain.



Some of the aircraft operated by the winners.



1611th Air Trans. Wg. (Med)
McGuire AFB, New Jersey
Military Air Transport Service
C-118 — C-54 — C-47

A total of ***61,741 hours*** were flown during the award period without a major or minor accident. Every ***type of weather*** phenomenon except tornadoes were encountered while flying in all the climatic zones. Communications and navaids in ***foreign countries*** presented many hazards during IFR letdowns.

★ ★ ★

49th Fighter-Bomber Wing
Misawa AFB, Honshu, Japan
Far East Air Forces
F-86F/D — C-119G — B-26

The large majority of the pilots are ***young and inexperienced*** with less than two years in jet fighters. During the spring months, ***fog, low ceilings*** and ***light precipitation*** hampered operations and made them more hazardous. The weather is "famous" for going from clear to ***below minimums*** in a 15-minute period.

★ ★ ★

33rd Fighter Group (Def)
Otis AFB, Massachusetts
Air Defense Command
F-89D/H — F-94C

Around the clock operations in all types of weather was the keynote. ***Marginal weather,*** frequently below GCA minimums made recoveries more hazardous. The main instrument ***runway was closed*** one-third of the time due to construction and repair.

★ ★ ★

388th Fighter Bomber Wing
Etain Rouvers, France
U.S. Air Forces in Europe
F-86F

Opening of a relatively new base, coupled with ***inadequate navaids*** required close observance to safety practices. Unusually ***severe weather*** throughout Europe added to the hazards. The base operated ***without a GCA*** unit for a large portion of the award period and, due to political considerations, the homer was located within the Air Field boundaries, necessitating an ***unsatisfactory penetration*** and ***letdown*** procedure.

439th Fighter Bomber Wing
Selfridge AFB, Michigan
Air Force Reserve
F-80

There were no accidents or incidents during this period. The mission of the Wing is to train personnel so as to become "operationally ready" for fighter bomber efforts.

★ ★ ★

302d Troop Carrier Wing
Trenton County Airport
Wilmington, Ohio
Air Force Reserve
C-46

In accomplishing a "no accident or incident" record, the Wing participated in operation "Sixteen Tons" and transported personnel for the summer encampments of the Reserve and ROTC groups.

★ ★ ★

197th Fighter Interceptor Sq
Sky Harbor Airport, Phoenix, Ariz.
Air National Guard
F-86

In training to maintain operational proficiency there were no accidents or incidents during this period. Operational missions were transition, instrument and tactical flying with formation, navigation and gunnery training.

★ ★ ★

141st Fighter Interceptor Sq
McGuire AFB, Trenton, N. J.
Air National Guard
F-86A/E

In supporting the Air Defense Command mission, no accidents or incidents were experienced. A complete transition from F-86A aircraft to the E models were made while performing operational proficiency missions.

Above, the armament of an F-101 is cold weather tested. Right, an ice-crusted B-47 outrigger gear is cold soaked.

When it comes to checking to be sure our birds can still operate when the temperature drops out of sight, the cold test hangar is the answer.

Baby it's Cold . .

ADDED TO THE many other requirements, the Air Force birds of today must be capable of operating at temperatures ranging from −65° to 160°F. At 65 below, cables may snap like dry spaghetti; intricate parts may not operate, and touching cold soaked metal with your bare hand would cost you a layer of skin. Design and manufacture must be keyed to this requirement and, to complete the picture, we must know just how a new piece of equipment will stand up. We don't want to send a Cheechako to do a Sourdough's job.

To be specific, the United States Air Force requires that all aircraft and ground and personal equipment used by Air Force personnel operate satisfactorily under all climatic conditions, or be capable of such after undergoing acceptable modifications. To meet this requirement, a climatic testing program has been established. The program is the responsibility of the Air Proving Ground Command at Eglin Air Force Base, and thereon focuses our story.

A bird's eye view of the main chamber of the Climatic Hangar displays a variety of aircraft.

Previously, all testing had to be conducted in natural locations. This procedure involved a multitude of problems. Long departed are the difficulties of setting up a complete testing operation far off in the boondocks of the Arctic. Arrived is the Climatic Hangar of the APGC, one of the most unique units of its type found anywhere. Its functions are two-fold. To supplement and reduce the required field-testing program and to make possible, year around testing under controlled temperatures and other climatic conditions.

As the name implies, the climatic testing program includes everything from the conditions existing in the Arctic to those of the Equator. The Laboratory is made up of

- Climatic Hangar
- Engine Equipment Facility
- The All-Weather Room
- The Armament Strato-Chamber
- Physiological Strato-Chamber
- Desert Test Room
- Hot Test Room
- Tropical Marine Test Room
- Cold Test Room
- Jungle Test Room
- Salt Spray Chamber.

All of these facilities carry out important test projects. However, this article will be restricted solely to the climatic hangar.

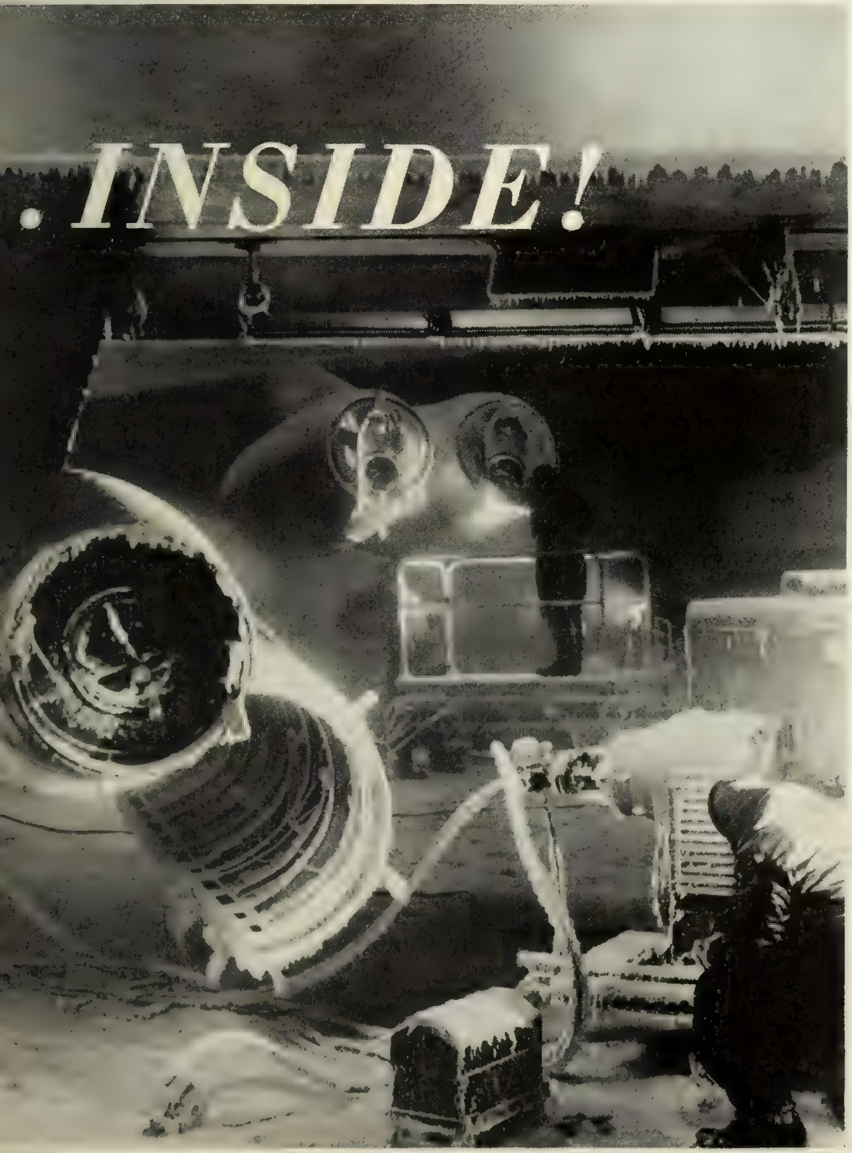
The climatic hangar is an insulated room with a clear working area of some 50,000 square feet. It will house a B-36 and several smaller aircraft at the same time. In addition to the temperature range, relative humidities can be controlled from 10 to 95 per cent.

Due to the extreme temperatures which will be encountered at all times within the main chamber and test

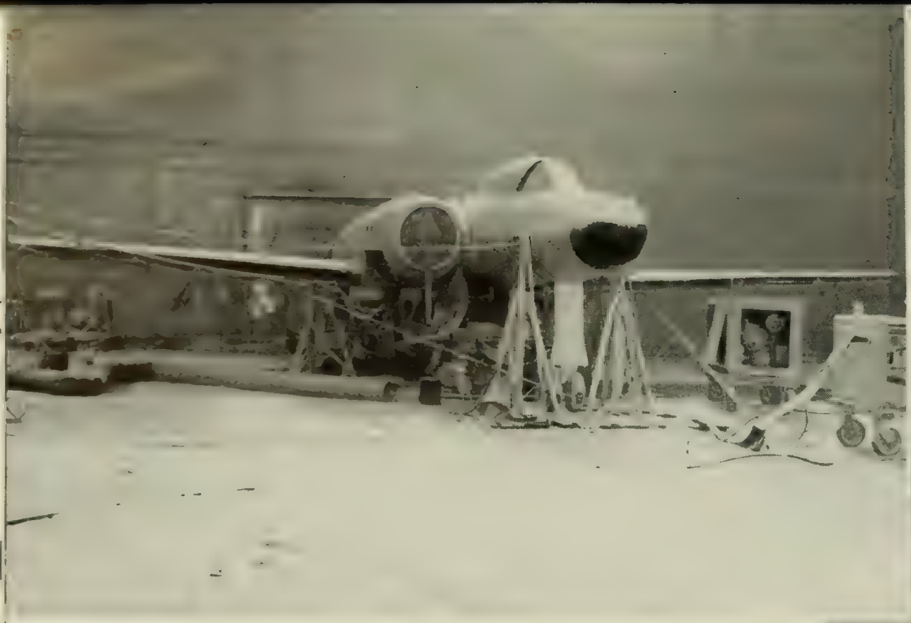
A landing gear actuator stand test is used to check operation of the gear mechanism.

o heavily clad airmen test the electrical equipment on an ice-covered RB-66 at 65° below.

.INSIDE!



A fire guard stands by as one engine is runup. During runup certain parts are checked.



The "deep-freeze oven" cold-soaks the aircraft, then many tests including actual firing of guns are performed.

rooms, special clothing must be worn. Clothes worn for cold testing are both Arctic ground type and heated suits. The electrically heated suits are supplied with power from mobile transformer units which can be placed at any location in the hangar or test rooms.

Project officers run up jets in the hangar and perform a multitude of tests. They can even fire the aircraft's weapons. The east wall of the chamber faces a firing range. This wall is fitted with five gun ports located in two elevations. The weapons are fired through these ports and the projectiles explode harmlessly in range 22 on the bay.

On the floor of the hangar is a pit for the testing of bomb racks and release mechanisms. Aircraft are towed over the pit and dummy bombs are dropped into a sawdust bed.

A wind machine, mounted on wheels and adjustable as to height and angle of discharge also is available. It will provide a 100 mph wind for use in tests which require the simulation of certain flight conditions. Apparatus is being designed, which, in conjunction with this wind machine, will simulate sandstorms, snowstorms, rain, and icing conditions, for testing de-icers, propeller pitch control and such.

Everything from gear retraction tests to engine runup is accomplished in this chamber.

The versatility of the hangar can best be summarized through reference to a claim by some engineers that "you can do anything in the hangar but fly." This claim, however, was disproved when a helicopter was actually flown a few feet above the hangar floor during a test.

For those who don't care to expose themselves to the elements, mobile observation rooms are available. These rooms are wheeled about the hangar floor enabling close observations through the anti-frost windows, without the discomforts of frigid temperatures.

Of course all types of precautionary equipment is installed. There are five different types of fire fighting systems. They include water fog, foam and carbon dioxide, just to name a few.

Personnel and equipment are protected against the hazards of carbon monoxide and explosive vapor by an automatic electrical detecting device which draws air samples continuously from eight points in the main chamber.

All in all, this is quite a facility. The climatic hangar itself and the specialists who operate and maintain it face a real challenge in simulating some of Mother Nature's worst moods. Here is another cross-section of our Air Force. . . . One that is destined to contribute its bit toward defense as well as safety of flight. ▲

Snow can start falling from a cloud-laden sky in a moment's notice. For those who must remove it and for those who must operate aircraft around it, the answer is the same. Be prepared. . . .

When the Whistle Blows!

BUSINESS and traffic in half a dozen major cities came to a dead halt. For three days, almost nothing happened. Among them were Dayton, Cleveland, Pittsburgh, Toledo and Akron. Snowbound. Trapped by tons of snow. That was Thanksgiving 1950. Last year, it was the Panhandle of Texas. What happened? Nothing. It just snowed. And snowed. And snowed. Everybody said it was "an unusual snow" — and maybe it was. But that's little guarantee that it won't happen in your town, or on your base this winter. They have lots of snow in lots of places every year; the same kind and the same amounts that you might call "unusual" for your particular location. Nobody gets overly concerned about the matter in those areas when the snow starts falling. Nor do they get bogged down in the stuff to the point that they can't operate.

The big difference in them and you is that they are prepared for the stuff. They know exactly how to cope with the problem, what they're going to use, and when they're going to start. To them, it's old hat. Just like getting up in the morning—snow in the winter. To keep things moving, move the snow.

But this sort of thing doesn't "just happen." The wand-waving technique for moving snow was abandoned some years ago. It's a problem. If your base is something like the average throughout the Air Force, you have roughly 15,000,000 square feet to shovel off before your base is operational. That doesn't include the first street, the first fire lane, nor the entrance to the coffee shop. That is merely the ramps and runways. With the average size snow shovel you can pick up about 2000 cubic inches worth of snow at a time. If you have just a two-inch snowfall at your base, and you alone are assigned the job of shoveling it off, you'd better start now. After that first shovel full, you have 29,999 more to go. Some little time before you finish, you'll agree with me that, "Snow removal is one of the most difficult tasks facing the northern Air Force base."

If you have a copy of SAC Manual 85-2 handy, you'll have the source of the quote. And you'll also have one of the best guides for snow removal planning that can be had for the price. If you can't find one of them around, check AFR 90-6. Best of all, read both of them, the following story and your SOP. To add more fuel to your

Above, sno-gos at work blowing the snow toward edge of the runway. Right is a picture of fir-tree marking.

The windrows are cut down to size by bulldozers. For tight spots you can't beat shovel brigade.

fire, suffice it to know that during the past three winters the Air Force sustained a total of 71 major aircraft accidents for which the basic cause factors were listed as "Snow and Ice on Runways and/or Airfield." Far too many of these also bore the brand of "Supervisory Error."

Here's a sample. The weather at takeoff time was clear with excellent visibility. The ops officer had briefed the pilot to fly target ship for an interceptor crew. This was a cinch. Nothing to do but fly a rectangular pattern for an hour and a half while the other jokers made the passes. This is the way to earn flying pay. A crisp cold morning, an airplane that flies like a dream—the sun in the sky and the world covered with snow. Life can be beautiful . . . almost too good.

Not just almost—it was. He slid into the landing pattern and played the approach to set it down as near the end as possible. With all this snow and ice around, there might be a slick spot on the runway, and besides, coming in from this direction you had to land downhill for the first half of the runway.

Almost over the end—better begin the flareout.

And then, WHAM! Who left that snowbank right on the end of the runway? The right wheel hit it.

But why load you with gory details. This was just one of the twenty-four airplanes that "bit the snow" last winter. Most of them happened on the runway. But judging from statistics there was no safe place to hide; the ramps, the taxiways and especially the overruns were hazardous.

This all happened last winter. The names can be changed but not the facts. When the runway is on a red cross it should not be used.

As it pertains to our sample accident, the regulation (AFR 90-6) is quite specific. It states, "Residual snowbanks will be established so as not to constitute a possible hazard to air or vehicular traffic during normal operations. Snow will be removed from runway overruns to a point 500 feet from the end of the runway and the full width of the runway. Snow will not be deposited at the end of such cleared areas."

In many respects, AFR 90-6 contains much more specific detail than that normally found in an Air Force regulation. Five essential elements for successful snow removal are specifically outlined:

- A definite, well thought-out and practical plan of action.
- Maintenance of equipment (including refueling trucks) in first class operating condition. This also means that when a storm is imminent, they be warmed and ready to go.

The removal is slow but spectacular process.

The final result, only after much hard work.

- Immediate availability of trained operators and helpers and maintenance personnel.
- Availability of electrical night-lighting and radio equipment with necessary spare parts.
- Trained, experienced and efficient leaders in charge of each team at all times.

The regulation is also pretty clear when it comes to planning requirements. Here is the law:

"Prior to the advent of each winter season, commanders at installations where two or more inches of snow is anticipated, will prepare a snow-removal plan incorporating, but not limited to, the following:

- A layout plan of the installation indicating routes and priorities for snow removal and ice treatment on runways, taxiways, aprons, parking and open-storage areas, roads, railroads, walks, and the location of snow fences, delineators, snow dumps and the like.
- Amounts, types and use schedules for available equipment, material and personnel.
- Assignment of related responsibilities to the weather officer, operations officer, transportation officer, installations engineer and any others concerned.
- A plan for training personnel in the use of snow-removal equipment, and personnel schedules to provide regular and relief crews on a 24-hour basis of operation."

Over and above the specific requirements of the regulation, each base has its own problems. The bulk of these problems concern facilities and people. To cope with these, each plan will vary somewhat in approach, but all make maximum use of available resources. Some even incorporate a plan for hiring additional civilian personnel on a seasonal basis. These are on call at any hour of the day or night to do the job.

Bases also vary in their approach of the actual task of snow removal. These approaches generally depend on the type of equipment available for use. The following is a sample received from one of our northern bases:

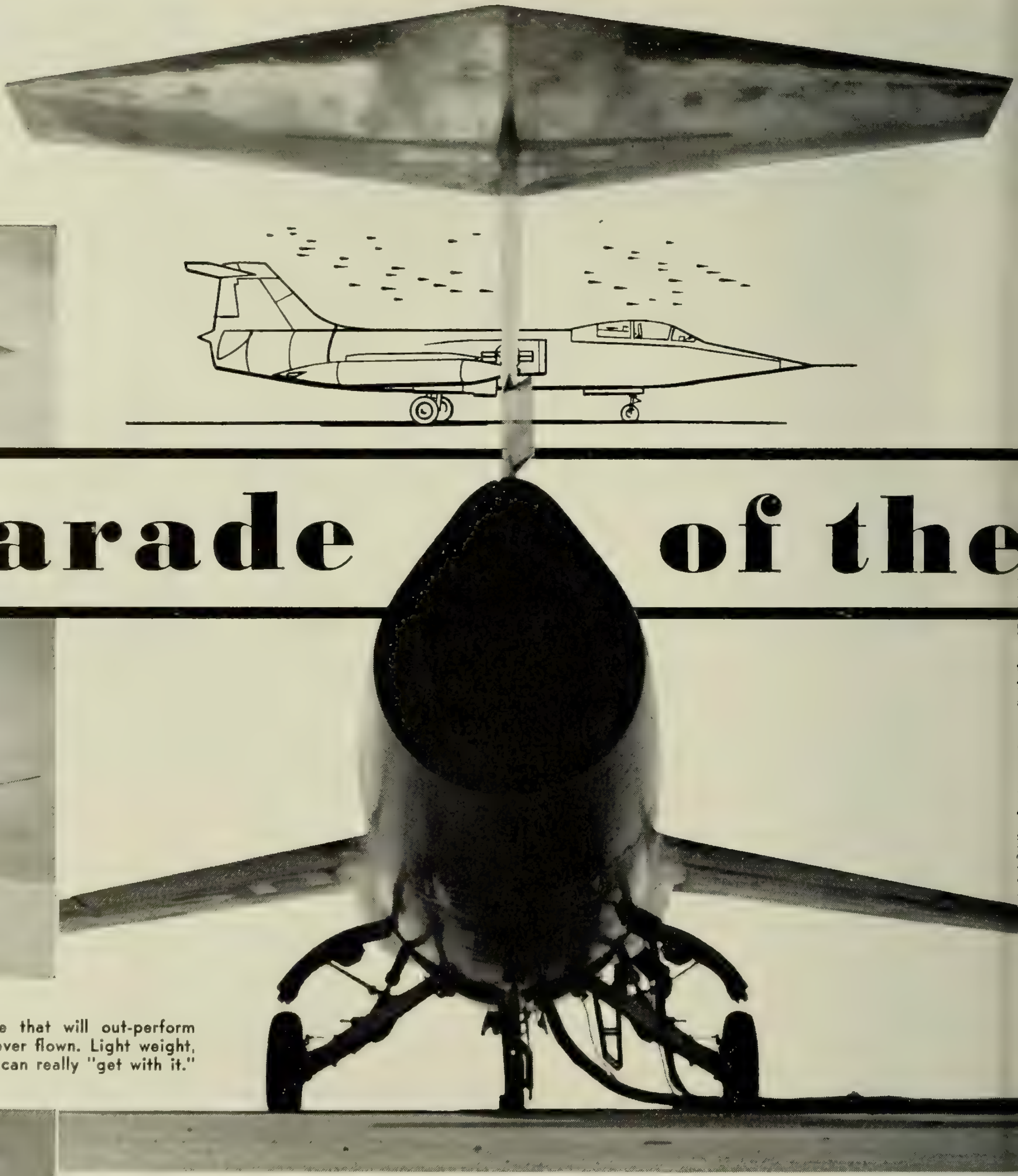
"In removing snow from the runway, the conventional type plows will start by plowing in echelon down the center of the runway, windrowing the snow toward the outside edges. One snow plow will make a single pass along the outside edge of the pavement, throwing the snow toward the center. The conventional type snow plows will plow the snow to the side of the windrow formed by the plow making the pass along the outside edge. The snow plows plowing from the center of the runway should operate at approximately 25 miles per hour until the snow has been worked to within one plow's width of the windrow formed by the snow plow operating along the edge of the pavement. The last pass should be made at a very low speed in order to form a neat windrow to facilitate the using of Sno-gos to blow the snow beyond the lights.

"Sno-gos will be utilized by spacing them along the runways on both sides in equal distance so that each plow has approximately the same distance to clear. The conventional type plows will be used on lower priority work while the Sno-gos are working on the runways. When the Sno-gos have finished the runway, the conventional type plows will plow the snow 50 feet beyond the edge of the runway. If the snow in the area beyond the edges of the runway is too deep to handle with conventional type plows, the Sno-gos will be utilized in clearing this area. Snow plows will clear the snow to the area within approximately five feet of the runway lights and the remaining snow will be cleared with hand shovels by a detail of men. Taxiways will be cleared in the same manner as described for clearing the runways.

"In the event of strong winds, it may be necessary to plow the snow all in one direction, starting at one edge. It may also be necessary to utilize a grader to make trenches parallel to pavement and approximately 100 feet on the windward side of the pavement to aid in the control of drifting. If the drifting condition is bad, two trenches approximately 50 feet apart will be made; then, as these trenches become filled the grader will be sent back to clear them out. This method of drift control has proven very satisfactory."

While it is obvious that these procedures will not be required at many locations, variations and adaptations may be employed. It has been proved that the system works in some of our heaviest snowfall areas. It should work for you. ▲

Parade of the



Here is an airplane that will out-perform anything you have ever flown. Light weight, easy to fly and you can really "get with it."

Tony LeVier
Director of Flying Operations
Lockheed Aircraft Corp

You may have heard it compared to a missile, you may think it looks like a missile, but this article by Tony LeVier should convince you; here's an airplane.

F-104

Centuries

WELL, BY NOW the F-104 Starfighter is probably the most widely talked about—and perhaps one of the most controversial—airplane flying in the world today.

What I mean is, people have heard so much about it that they're probably beginning to wonder if it is for real. And I can understand why they would feel this way. I've seen stories written about it which have ranged from the ridiculous to the sublime.

For example, some writers state that the bird will hit Mach 2 going straight up . . . (no comment!). Others liken it to a manned missile . . . (come now, men!). And others express frank skepticism that this design is legitimate . . . (it couldn't be more so!).

I want to tell you what the true facts are about the plane. And, above all else, remember this—the F-104A *is* for real.

Let me give some of the background highlights on her and then we'll get down into the specifics of performance, handling and safety features.

First off, because it establishes the plane's authenticity, I would like to pass along a quote by C. L. (Kelly) Johnson, Lockheed's Vice President in charge of Research and Development, and the man responsible for the design of the F-104:

"This airplane represents an evolution of literally thousands of design studies, tunnel evaluations, flight studies with experimental aircraft like our XF-90, and intensive performance tests at high Mach numbers of rocket-powered wing models. It represents the synthesis of the best design knowledge available from these programs."

If anyone in the aircraft business should know a good design when he sees it, he's Kelly Johnson. And when he says, "This is it," that's plenty good enough for me. And I've been flying long enough to want to know what I'm getting into before I go charging around upstairs in a brand new bird—as high as this beauty flies.

Actually, before we ever made the first flight in the XF-104, back in February, 1954, I had done some flying "towards the design" in a series of special in-flight dynamic tests conducted at the Ames Aeronautical Laboratory early in 1952. That was before we even started to cut metal for the F-104.

Back of all of the preliminary design studies (and a lot of those designs were more similar to today's competitive airplanes than our own F-104) were these basic objectives:

- We did not want to build an aerial "hot rod" that required the utmost skill and care in handling. We did not want to build a "stripped down" fighter.
- We did want to build a "pilot's airplane," a bird that is decent to handle, and we succeeded. For, in my opinion, the F-104 is easier to fly than the T-33 trainer. But I've said this before and I'll have more to say about it in a little bit.

It Fits You

Now, let's get down to business and talk about just what it's like to step up to this airplane.

The F-104 is a bird in which the pilot can really "get with it." You know the feeling you have when you drive a sports car, as compared to larger, standard-make models. It's like "being a part of the machine." Everything is compact, built snugly around you. Like slipping into a tailor-made suit. It fits—and comfortably. That's the way it feels to get into the cockpit of the Starfighter. And we pilots here at Lockheed had a lot to do with the cockpit design.

For one thing, the pilot is properly placed, visibility is excellent and everything is real handy. Controls are mighty easy to reach, right at your fingertips. And there aren't a battery

The author, who made the first flight, needs no introduction to FLYING SAFETY readers.

of knobs and dials that would require a mechanical wizard to figure out. We've kept it real simple.

I guess that simplicity is the essence of safety in my book. The fewer switches to throw, the fewer dials to look at, the fewer handles to move, all improve the pilot's chances of not making a mistake. We've done our best in this respect on the F-104.

For cockpit temperature you set the dial and forget it. Fuel management? Just like your automobile, unless you're carrying external fuel. Then you have one switch to throw. These little things add up.

About the way this plane "looks." To me it's like an artist's sketch of what I used to wish I had back in the old racing days. Man, if I'd had a plane like this, they would have had to rewrite the book.

New Look

This is the first of the "new look" airplanes. And there are going to be more. So you might as well get used to it. Because if we're going to be flying faster and higher than we've ever flown before—the airplane configuration is going to become sleeker and "more to the point." It has to be so. Aerodynamic and thermodynamic considerations will dictate it.

But don't let this new look throw you. Oh, I've heard pilots come out, take their first look at the F-104 and say, "What ever happened to the PT-13?"

Well, the PT-13 had its day, a long time ago. And then we stepped through the P-38 era. Remember, it was a pretty hot job too, the first time around. Along came the F-80, starting this country's pilots into the blowtorch-riding business. Jets became faster and faster, moving into the century series. And now, the F-104.

The state of the art has progressed by leaps and bounds in the past few years. And just as airplanes are able to do more and more, the capabilities and limitations of the pilot himself are now being made a vital part of the design consideration.

Airplanes like today's F-104 have electronic devices that make them fly the way they should. Control is no longer limited to the human reflex and response. Now there are controls which have ways and means of sensing movements of a tiny fraction of a second—and controlling them.

This close-up shows one of the many new design features, the razor sharp leading edge of wing.

And the F-104's "fineness of control is the finest." New stability augmentation devices pre-sense and simultaneously correct for gusts and tricky air which might upset stability.

To my knowledge there is no other airplane flying with flight characteristics as good as the F-104's. Part of the reason for these good flight characteristics lies in our power control systems. We pioneered power boost controls on the P-38, and today at Lockheed we probably have the widest range of experience with hydraulic powered flight controls of any company in the aircraft industry.

What about its speed and inflight performance? Okay, I'll tell you.

Although it has ultra-sonic speed, this plane handles like a dream all the way. And for landing it's in the same speed range as the other century series fighters — touching down at around 135-150 knots, depending upon weight. This puts it within 5-10 per cent of other late fighters.

Pattern speed is normal for the century aircraft, around 200 knots. And the Starfighter can really slow up

A downward ejection seat makes for a manual canopy that weighs one-fourth of power models.

with the help of new wing flaps on the leading edge as well as the trailing edge of the wings. Approaches are standard. And it could take off and land on a six to 7000-foot runway.

Of course, our top speed is in multiples of what we've grown accustomed to. So this is almost like eating your cake and having it too. We did this by building a plane that was both light in weight and structurally strong, and designed from the outset for supersonic flight.

As Bill Ralston, project engineer for the F-104, has pointed out in discussing structural features, the short, stiff wing is one of the speed secrets in the F-104. Because the airplane is light, it didn't need a big wing. But that wing isn't weak. It will carry dynamic loads of more than a ton per square foot.

The entire airplane is strong — plenty strong. Take the speed brake housing, for example. It had to be strong to take the loads when the flaps are opened at high speeds. But there's no need for this strong structural member to use up weight for only one purpose. So it serves as the dive flap pivot fitting, an engine mount fitting, and splices the bulkhead together.

And just to make it lighter, we used part of the strength of the dive flap hydraulic cylinder to make up the strength of the housing.

By having a downward ejection seat (incidentally, a safer type of seat), we have a simple "unlatch it and open it yourself" type of canopy. We didn't need a power operated canopy with its heavy rollers, heavy framing, electric motor-driven screwjacks and the like.

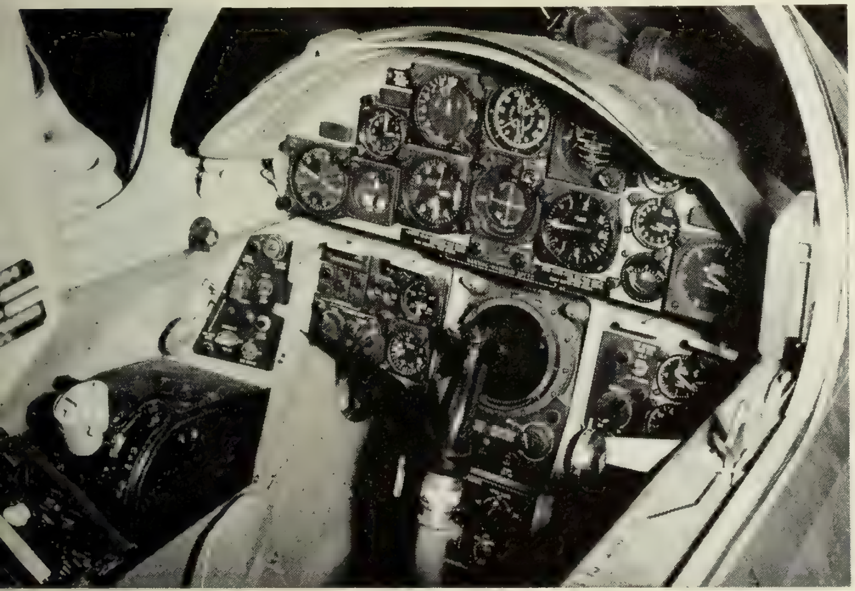
Another thing, we also didn't need the associated emergency systems that go with a power canopy, nitrogen bottles to blow it off if the screwjack failed, and so on.

Simplicity

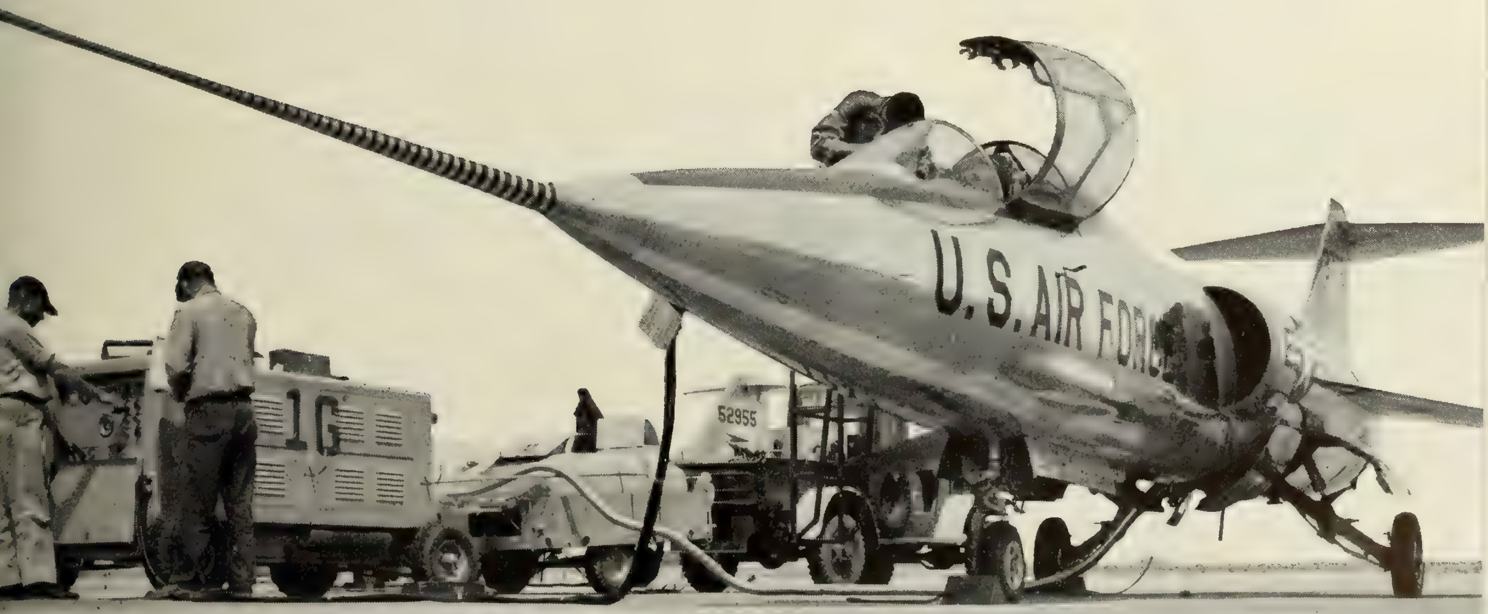
Complexity breeds complexity. Every complex device must be backed up with another because complexity can't always be trusted. For that reason, we made the F-104 simple throughout.

And, incidentally, contributing to the weight saving design principle, a power-operated canopy weighs from two and a half to four times as much as the one on the F-104.

Sometimes we are kidded about our "little airplane" and they allow as how it can't do much of a job, being



In this bird the pilot is properly placed, visibility is excellent and everything is real handy. Below, the ground crews really will like this airplane too.



so small. Well, that's pure hog-wash, and here's why:

A .44 Magnum pistol is another small weapon, but it will drive bullets through an automobile engine block. It will kill the biggest man—just as dead as an elephant gun would. And that's the mission of a fighter—to kill.

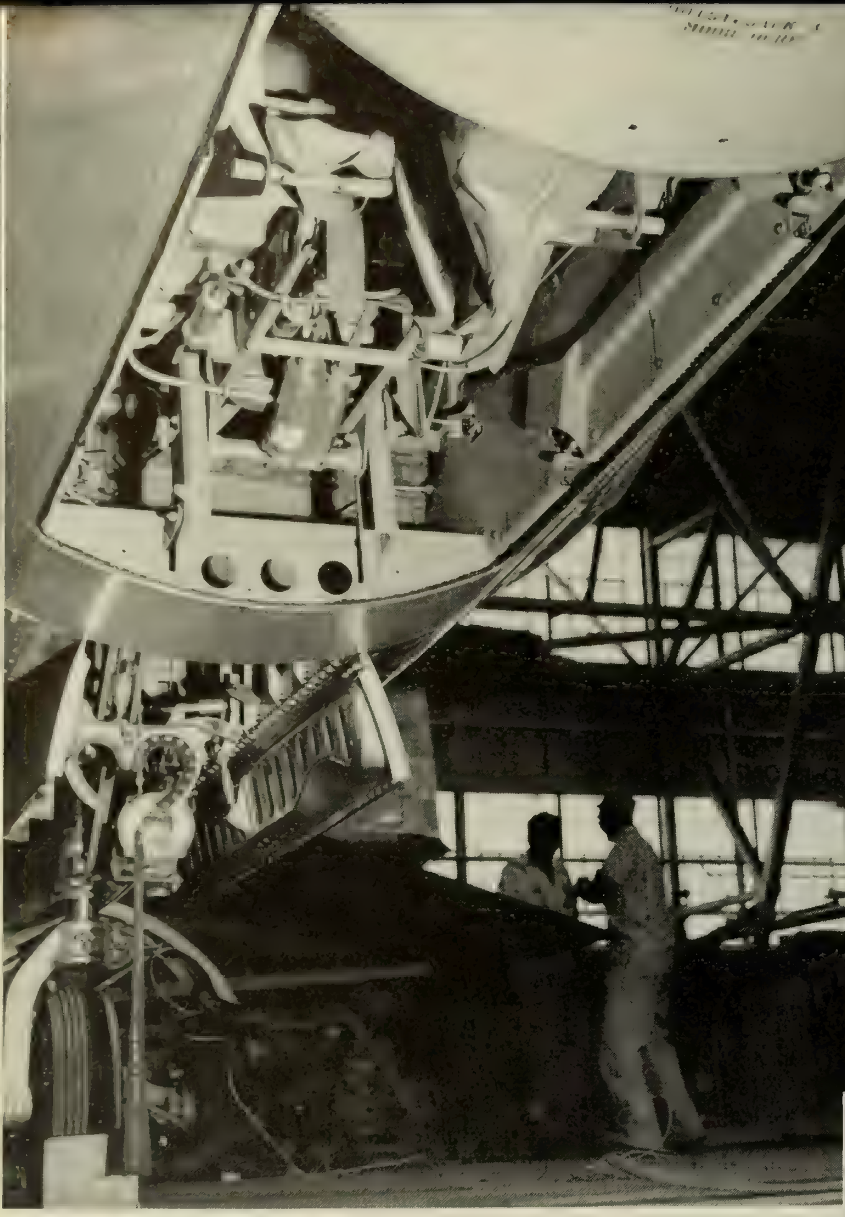
Whether it is a bomber or a fighter makes no difference to the F-104. It has ample equipment to take care of either.

I mentioned earlier that the F-104 is a pilot's airplane, that it is easy to fly. Here's a good example of that.

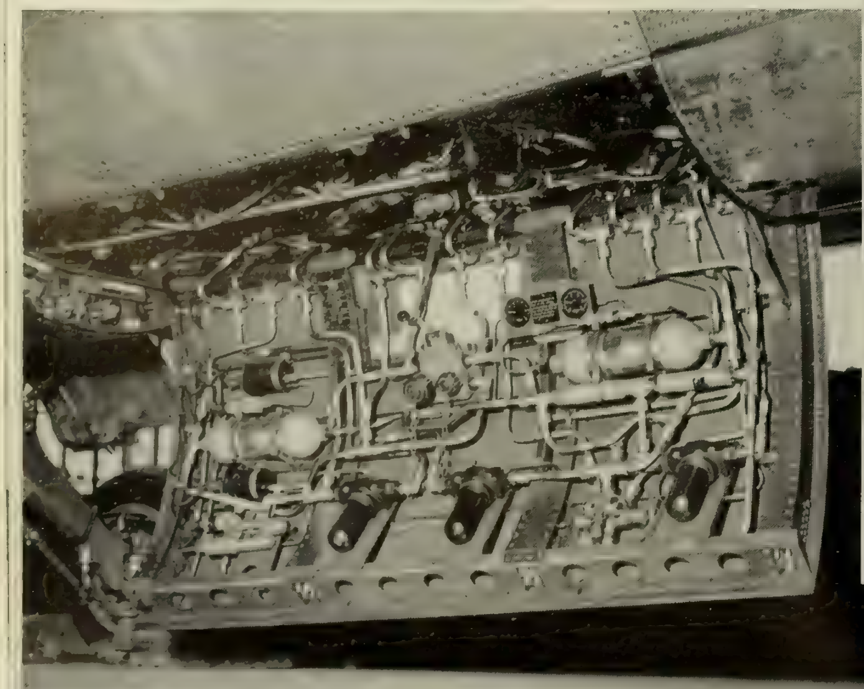
Early in the flight test program of the Starfighter the Wright Air Development Center sent out a test pilot who specializes in control characteristics of aircraft. He flew the F-104.

At approximately 45,000 feet, he tipped the airplane into a dive. Then he took his hands and feet off the controls. He wanted to see how far it would go before he had to take the airplane in hand.

He went through the speed of sound and to high Mach numbers without touching the controls until the approaching ground made it necessary. He said it was "just like riding an elevator."



Above, the nose gear retracts into the fuselage. The forward hatch has been removed here showing bottom of downward ejection mechanism. Right, are pictured four Century series fighters. Below, is the "easy to get at" hydraulic panel located just aft of the main landing gear.



Left, another view of the "do it yourself" canopy. Above, shows leading and trailing edge flaps.

Some of you know Chuck Yeager. He was the first man outside Lockheed to fly the F-104. Chuck has flown in a lot of birds and some haven't been so good from a pilot's viewpoint. So he was skeptical when preparing to go with the F-104. I'm glad he was skeptical because he's one of the best judges I know.

I'd just like for you to know that he hadn't been off the ground 60 seconds until he started talking on the radio. I never heard Chuck talk so much, and it was all praise—"Never flew anything like it . . . Stability and control are perfect . . . Fantastic . . . A real tiger!"

Safety Items

I'm sure you're interested in safety. We all are. Well, this is one plane whose design grew hand-in-hand with the slogan, "Safety First."

A lot of the airplane's inherent safety stems from the fact that peak performance has been designed into the F-104. When you're a fighter pilot you've got to have the performance, the ability to beat the other guy to the punch, or you're not going to be in business very long. At least not nowadays, in view of what we know is coming along behind the Iron Curtain.

So when you've got the performance, superior performance, you're in a safer position than you would be if your bird was second best. This is the best kind of life insurance a pilot can have.

The Starfighter's control systems are designed specifically for pilot safety. For instance, we have two completely separate and distinct hydraulic systems. And if we lost both hydraulic sources—say in the case of engine seizure—we have an emergency hydraulic pump and generator, a ram air turbine, that doesn't depend on the engine. Even if the engine quits, however, it will still windmill enough to run the pumps.

Along this line, here's an incident I think will interest you. In the early days of testing the XF-104 prototype I lost the engine. I had lots of altitude so I headed for home at Muroc. I glided more than 50 nautical miles home for a landing.

You might be surprised that this airplane glides. Actually, with everything up it is so clean that it glides extremely well. You can figure on a glide ratio of ten to one.

Our landing gear group has done a real job on the F-104. This gear falls free and locks within three to four seconds. Considering that you have 15 to 20 seconds on the roundout, this means you don't have to lower the gear until you are over the runway and have it made.

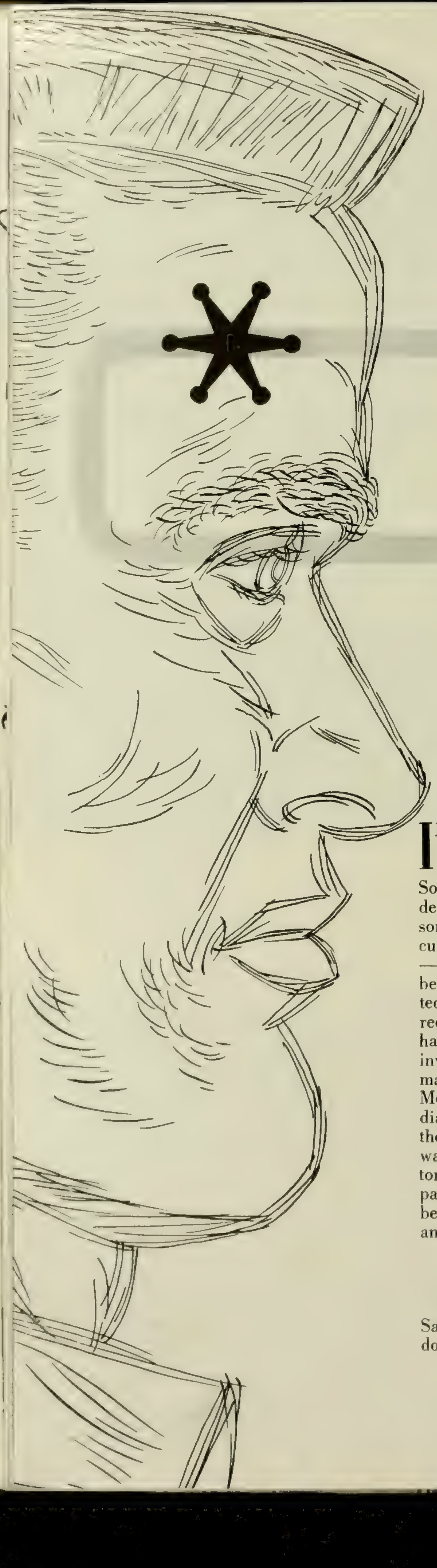
Another thing about the F-104 that you will like from a safety standpoint is the engine, a General Electric J-79. This plane's engine response is the best of any jet and compares with, or maybe even tops, piston engines. Acceleration is prompt and strong, thus correcting an old complaint about jets, and this is over the entire range of flight.

Speaking of the engine brings us back to speed and while the F-104's speed to date has been exceeded by research aircraft, they have been highly experimental rocket planes designed to fly only a few minutes at maximum thrust. And it takes pilots months, with special training, to be able to fly them. But the F-104 is a combat plane, built to be flown by pilots assigned to tactical outfits.

Summing it all up, I'm convinced that this is the best fighter plane ever built. And not just because I like what I've felt when flying it, or because Air Force pilots have heaped praise upon it, but primarily because any properly schooled and well checked-out pilot will find the F-104 easier to fly than the Air Force's standard jet training plane.

Sure, it's hot—and new—and different! But it's also as normal a progression from what we've been flying as a change from yesterday to today. There's always something new under the sun. We've just brought tomorrow here today with the F-104.

I wish that all Air Force fighter jocks could feel the thrill of flying the '104. Plenty of you will, before long. That will be a great day. Then, paraphrasing an old slogan, you'll be proud to say, "Ask the man who's flown one." ▲



This is the final article in the series prepared for FLYING SAFETY by Lt. Col. Mulholland. It, like all of the previous stories, is close to our hearts. I am sure you will join with us in thanking the author for his down-to-earth approach to our many flying problems.

Recognition* of Error

Lt. Col. Mitchell J. Mulholland
Safety Research and Analysis Div., D/FSR

IN THE FIRST article in this series it was pointed out that human pilots make errors constantly. Some of these errors pay off in accidents, some do not. The reason that some do not is attributable to the circumstances. However, a bigger reason—and one that we can exploit to our benefit—is that some errors are detected in time. In time, that is, to correct the mistake before something happens. This timely recognition may involve merely spotting an error of manipulation or a mistake in figures. More often though it goes deeper into diagnosis of trouble symptoms and the recognition of where human error was a factor in producing the symptoms. Here once again professionalism pays off, and error recognition can be materially aided by alertness, by anticipation and by prudence.

Up and Locked

Remember the cadet who flew from San Antonio to Dallas with his wheels down and wondered why it took him so long? The same thing on a less spectacular scale happens to every one of us once in a while. When an airplane starts doing peculiar things the chances are good that it's your fault rather than the machine's. But it's funny how far we will go sometimes in our bland assumption that the machine is at fault. A classic case occurred some years back, in which the pilot probably owed his neck to a forgiving airplane. The airplane and pilot are obsolete but the mental processes involved are most germane to this discussion.

The pilot was making his first water takeoff in an OA-12, an aircraft which had to be seen to be believed. The gimmick in this case was that the prop pitch control was a knob protruding from the upper left corner of the instrument panel. On a hasty pre-takeoff check, the knob appeared to be in the full forward position. Power was applied and the bird lumbered forward in a cloud of spray. At full throttle only 1600 rpm showed on the tachometer. Noting this, the pilot made

his first deduction—"Tachometer is out." Lord knows the airplane was making enough racket — sounded okay. Of course the takeoff run was pretty long and sluggish, but as this was his first water takeoff in this bird the pilot figured it must be this way all the time—deduction number two. Surprisingly enough the thing became airborne and clawed for altitude among a forest of masts, derricks and smokestacks. Time to reduce rpm, thought our hero, and pulled on the pitch control, which naturally didn't move. And the trigger mind of the pilot leaped to its third deduction — something wrong with the prop control!

Low rpm, long takeoff run, prop control won't come back—light finally dawned, and the pilot pushed the prop knob *forward*. Power took hold with a stinging howl and the bird climbed upstairs in blissful relief. The little knot of anxious friends, who had watched the whole episode from the seaplane ramp, wiped their eyes, stopped slapping their thighs and returned to work, limp with laughter. Old buddies.

The pilot at least retained a lasting impression of just how stupid you can get. You see, the pilot was this writer.

The interesting point here is the appalling reluctance of the human mind to accept the possibility of error when it can blame things on a machine. Here the airplane was exhibiting such obvious symptoms that it might just as well have been yelling "Shove up the prop pitch, you idiot!" But the pilot, with a cranium full of oatmeal, refused to listen.

Familiar Situation

In analyzing accidents we frequently find ourselves baffled by cases such as that of Lieutenant Squash, who landed his F-86 at Parsnip AFB one sunny day—everything fine but with his gear up. Checks showed there was nothing whatsoever wrong with his gear system. The horn worked, the selsyn indicator and warning lights worked; in fact, Lt. Squash blandly assured the tower "turning base — gear in the green!" Mobile Control spotted him, fired two red flares across his nose, the tower gave him a red light. Every one of the safeguards worked the way it was supposed to, but all the king's horses and all the king's men couldn't stop Squash from pranging his bird. Evidently the source of the trouble can be isolated between Squash's earphones, but why? why? why?

Before we rush right in and denounce Squash as a blithering idiot, let's first realize that he has already shown himself a thousand times to be capable of landing an aircraft on its wheels. So have we. In other words, there but for the Grace of God go we. So let's at least settle this disquieting thought before we start rolling the drums and marching Squash into an F.E.B.

At first blush, the baffling thing about an accident like this is the blithe disregard by the pilot of all warnings, even to the extent of his own statement to the tower that his gear was "in the green." Digging a little deeper it becomes less baffling. The basic reason Squash's mind didn't register these warnings was because as far as he was concerned the gear *was* down. Heck, the gear is *always* down when you're turning final. He was in a familiar situation—everything appeared to be normal, so he concentrated on the landing. The possibility of something not being normal never occurred to him. So all these warning sounds and signs just sailed past his head. They had no meaning for him, they were just so much background clutter.

Each of Lt. Squash's thousand previous landings had involved a pattern, a sequence of events, culminating in a successful landing. This time something disturbed the sequence, but as the pattern progressed all the old familiar details slipped into place, except the gear, that is. Man is a creature of habit and he resists change. If you don't believe that, try changing the hours for the coffee break in your shop and see how far you get. Or—you, yes, you! How long did it take you to start saying Bravo instead of Baker? Haw—I thought so. I still say Baker, too.

Why bring all this up? Just in case you're thinking of curing Lt. Squash's trouble by adding another gimmick to his procedure. It was years ago that they thought up the idea of requiring the pilot to make that gay little remark about his gear before landing. This, they thought, will cure everything. It will remind him for sure. But as you see, it doesn't. It's just another little chunk of ritual for him after he has said it a few thousand times. He might just as well be saying, "Win With Willkie," for all it signifies. We can figure that the same thing would happen to any other additional warning device. That is unless we want to reach back into history and exhume that marvelous foot-buzzer they had on the BC-1. Actually that was probably a darned good idea. It gave the pilot a hot foot instead of blowing a horn, and as I recall, the BC-1 was not noted for inadvertent, gear-up landings.

In any event, the point of Lt. Squash's troubles is he did not recognize his error in time. And characteristically he disregarded or misinterpreted all the warning signs because it never occurred to him that Squash could have made a mistake.

Just Mislaid

This same attitude, compounded with a lot of wishful thinking, crops up in cases of navigation error. The pilot is lost but he refuses to admit it. He gets radio signals or sees landmarks that he promptly identifies as being what he wants them to be, not necessarily what they are. In the old prop jobs this could be good for a laugh—in a jet it is no laughing matter. It used to be that a pilot could say, "Heck, I wasn't lost—I was just mislaid." In a high speed jet, using fuel at a gillion gallons per hour, he can't afford to be mislaid. He either knows exactly where he is and when he'll get in, or he's lost. In our modern aircraft, deluding ourselves and pampering our pride are expensive luxuries. We have to face facts and take action right away. Pride or no pride, getting lost is an emergency and we have to call it that. There are people on the ground who can help us if we holler soon enough. They can't salvage much from the mess if we wait till we're down to a dram of fuel.

Fuel! We all know there are few things worse than running out of go-juice, and few things that are harder to excuse. Fuel consumption is figured against time en route before we take off and should be monitored throughout a flight. But sometimes our arithmetic fails us—our figures miss the mark. How often, though, has the sobering realization of our error penetrated only when we see the gages getting perilously low and we still have a long way to go? And how often have we pushed on, rationalizing that "Oh heck, it's probably the gages"? Higher than expected fuel consumption will show up early in a flight if it is being watched.

Errors in figuring should show up after a few check points if you're following things the way you should. And here comes the crux of the matter: just because you cleared for Foster doesn't mean you have to push through if it looks as though you'll be coming in on the fumes. Every Air Force Base, every Naval Air Station, and many of the civil airports along your route, can fill up your tanks with precious fuel if you go on in and ask them. And what's wrong with changing your flight plan en route, even if it was necessitated by an error on your part? To admit and rectify an error nullifies its effect. To push on through is really just an attempt to prove you didn't make a mistake. The trouble is, *you did*, and you may well compound it into a worse mistake by augering in with a windmilling engine short of your destination. All this second mistake will prove is that you were a fathead.

Recognition

As you can probably see, recognition of error is frequently very closely allied with anticipation of trouble. An error in flight planning may have serious effects on the subsequent course of a flight or on the arrival at the destination. Once an error has been detected and remedied, all its ramifications bear scrutiny. It may well make a good deal of difference in the circumstances of your arrival. A time or fuel error may mean your arrival when weather is worse than you had figured on, or when you may not have the fuel you need to go to your alternate. Think it all the way through.

The BC-1 was not noted for gear-up landings. The pilot got a hot foot, not a horn.

A few months ago a B-25 leaped off in the Middle West on a non-stop IFR flight to a West Coast base. At best this was stretching the range of the airplane a little, and headwinds made things worse. The pilot had badly overestimated his groundspeed, but as he passed his check points this should have become apparent to him. As far as is known he had never been in to his destination base before—it was surrounded by high mountains and had a complicated letdown procedure. It was obvious he was going to arrive after dark and the weather was known to be rugged. In spite of all this he pushed on through, arriving in the destination area without enough fuel to be sure of reaching an alternate. Still overestimating his groundspeed and probably worried about his fuel he started his letdown procedure too soon. He didn't let down very far, only to about ten thousand feet, where he joined many of his predecessors on the side of a mountain that is one of America's most notorious aircraft graveyards.

This pilot had flown directly over two Air Force bases right on his route, one of them at his half-way point. Several others were near his route. At any one of them he could have refueled and made a further check on the weather. Instead he flew into a really rough situation with minimum gas. Did he recognize his error and ignore it, or didn't he spot it at all? This we will never know. But it's easy to see what he should have done.

The same thing applies, most urgently, on an instrument letdown. This is one time above all that a pilot must know *exactly* where he is. If he makes a mistake he has to rectify it right now or execute an emergency climbout. Saying "oh hell" and bulling his way on down is simple suicide and nothing more, especially in hilly or mountainous areas.

A tanker started one of these winding letdowns into a base in a West Coast valley one night. The crew was unfamiliar with the area and they got balled up. Instead of going back upstairs and getting his ducks back in a row, the pilot spotted the lights of a city under him, assumed it was the city he wanted it to be and continued his letdown, right into the side of a

Mathematical talents that once only required counting kids to see how many were eaten up during night, now must solve equations in nuclear physics or perform lightning fast calculations during high speed flight.

medium-sized mountain. Of course the city was not the one he thought it was. It was another town, about 10 miles away, and that's all it takes in that kind of terrain.

Three Approaches

One of the most apparent ways of heading off possible error by anticipating it is to get all the information lined up ahead of time. If an instrument letdown looms as the probable conclusion of the flight, the more the pilot knows about it before he gets there the better. Runway length and direction, frequencies, letdown procedures, forecast weather, landmarks—the time to know all these things is long before the payoff. Learn them at leisure, then use the knowledge when the time comes.

A useful adjunct to anticipation might best be called imagination. It shouldn't be overdone, of course, but an intelligent imagination can alert a person to a lot of the possible goofs he may be likely to commit.

Imagination can frequently see through the possibilities of some of the booby traps in aircraft and procedures. It can warn of the disastrous results if something is done wrong. It helps by giving a mental picture of what's going on in the various systems when controls are actuated. Instead of dry words or diagrams it can visualize fuel gurgling through lines, hydraulic pressure surging through valves, vital components getting overheated. As long as it is controlled by thorough knowledge, imagination can be very helpful in picturing situations that can arise. We certainly don't recommend the conjuring up of bogeymen, but what has been thought of as "pilot's intuition" or "instinct" is really just imagination based on knowledge and experience.

The third and most important approach to heading off error or anticipating it is prudence. This is a better word than caution, because rightly or wrongly to many of us "caution" implies reluctance to act, lack of the aggressive spirit demanded by combat operations. Prudence isn't like that. Prudence is just good horse-sense. The prudent pilot doesn't push into something he's not sure about. When the gages show 150 rpm mag drop, low oil pressure and a few other things, he doesn't shrug, say "here goes nothing" and take on off. He doesn't leap off on a "Oh well it'll burn off by ten o'clock" weather guesstimate. If he's not sure about something he makes sure of it before committing himself to a dubious course of action.

Prudence is something we have all sinned against at one time or another. In wartime, in a combat situation, it's forgivable — first things must come first. But most of the time we're not in a combat situation. We're training ourselves and developing and conserving our aircraft so we'll be ready when and if the whistle blows.

The basic design of Homo Sapiens hasn't changed for a long, long time but the things he has been asked to do have changed tremendously. The same hands, senses and brain that were once devoted to such simple pursuits as knocking over a woolly mammoth for a community supper, are now expected to guide with accuracy a precision machine at faster than the speed of sound. Mathematical talents that once only were required to count the kids at sunrise to see how many were eaten up during the night, now must solve prodigious equations in nuclear physics or perform lightning calculations during high-speed flight.

Man is really quite remarkable when you stop and think about it. We crowd more and more requirements on him all the time, yet with amazing resiliency and adaptability he does the job. He is even capable of doing a job safely. Really he is so good that if we're not careful we pile things on his back until something has to give. When it gives, we blame it on him.

To sum up. Accident investigations are not courts martial—we are seeking causes, not scapegoats. On the other hand this does not imply that our pilots should be mollycoddled. They are military men first, and we have a right to expect them to be professional. But to approach a pilot error accident as though the only objective is to fix blame, is not going to produce results for the Air Force. We have a long way to go, but two vital principles should guide our efforts:

- We are all in this thing together. So we cannot assume that our assignment to investigate or review an accident implies that we are more capable than the pilot involved, or less inclined to err.
- The pilot is 50 per cent of the man-machine combination that we call a weapon. His inner workings deserve at least as much research and study as does the machine half of the combination. ▲

The preflight planning before chasing one of these girls involves a lot of coordination.

"Tai-Fung" Chasers

Above, is a typical "eye" to a Pacific typhoon. Surface winds around it range high as 170 mph.

THE RECIPE might read: Take one weather reconnaissance outfit, add numerous jolts of severe turbulence, some torrential rains, with a liberal smattering of lightning and black clouds, shake well and presto! . . . you have a typhoon chaser.

Do I see you wagging your head, meaning that you take yours straight and don't need a "chaser"? Then, maybe you'd rather recline on the nearest sofa and read about it instead. Indulging in pursuit of these fabulous storms of the Western Pacific is somewhat strenuous.

Okay. Do that and I'll try to fill in the answers on the manly sport of typhoon chasing. But, first—let me introduce myself. I come from one of the top weather recon squadrons in the world—the 54th Weather Reconnaissance Squadron. Let me substantiate that with some proof positive.

Our squadron came to Guam nine years ago. Since then, we've ridden herd on 151 typhoons. We've done a lot of flying without an accident—over 48,000 consecutive hours since October, 1952. We fly more tropical storm and "cyclone" missions each year than any other recon squadron in "el mundo." (We will pause 10 seconds to listen to the cries of rage from our cousins, the 59th Weather Recon Squadron in Bermuda, as well as other storm hunters.)

We belong to the 1st Weather Wing of Air Weather Service (MATS), and our outfit daily patrols 800,000 square miles of the Western Pacific pond when it isn't busy riding herd on a "Vulture cyclone." Don't let that "Vulture" throw you. It happens to be a bird's name specifying the tracks flown by the Typhoon Chasers.

Our area of responsibility extends from the China Seas to the International Date Line (where today regresses into yesterday), and from the Equator to 25 degrees North Latitude. Naturally, it follows that we're able to compile a heap of weather information over that large a space.

We have two fine little detachments of the 15th Weather Squadron, forecasting the movement of circulations out around these parts. One of these has its spread here at Andersen AFB. The other has a holding at Clark AFB in the Philippine Islands.

We spent 11,467 hours last year branding 19 different typhoons. What's more, we didn't compromise flying safety in setting these marks. Our squadron had (and still has) a very thorough safety program in action. We don't have dancing girls but we do have everything else that makes for a good, informative show. We emphasize the fact that a competent individual usually is a prepared one.

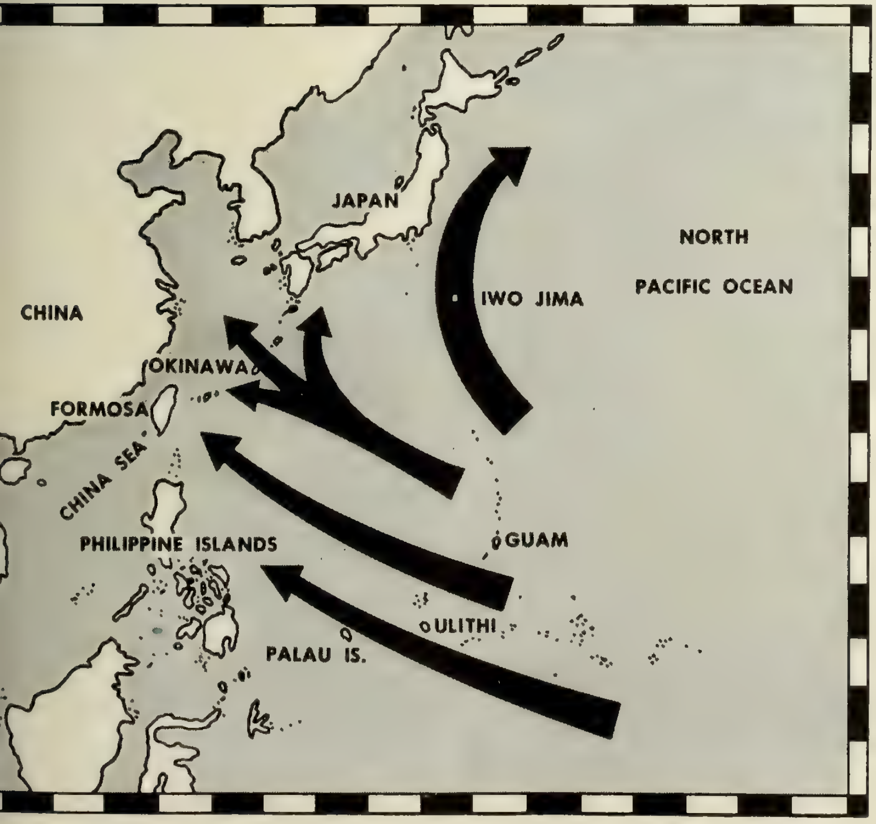
Now, you take a record like ours and you'll probably wonder: How does it happen? Friend, take a look at the experience level of the pilots. Ten throttle "jockeys" had over 4000 hours each. Our "boss" man tops the list with 7100 plus. Most of the flying personnel have had considerable experience penetrating typhoons. The OIC of the weather section, had 47 penetrations during a single tour.

There's an incomparable thrill awaiting those who venture into the inner sanctum of these Western Pacific tempests. Sure, they have names like the gals in Philly and Denver and 'Frisco, and, brother! you "ain't never" dealt with more tantalizing personalities. But, while there may be a fairly definite pattern to their lunacy, each has its own peculiarities.

Some are born one day and a short time later become yesterday's headlines. Others seem to live relatively long, robust lives. Some have only light turbulence; others seem severe enough to tear the engines from their mountings. Some have large ill-defined "eyes," while others have small distinct centers. Some have formidable barriers of cumulus boiling like a volcanic eruption in the "wall" cloud surrounding the "eye"; others have virtually no "wall" cloud.

Join us in a visit to the 54th Weather Reconnaissance Sq. They are known from far and wide as the "Typhoon Chasers," or if you prefer the Chinese dialect, "Tai-fung" Chasers.

Captain Lyle P. Earney



Typhoon Is Born

In China's Cantonese dialect there's a word for these storms: *tia-fung*. The *tai-fung* generally is born in the hot, humid latitudes hugging the Equator. Like the young colt which eventually becomes a bucking bronc, the storm goes through stages leading up to the time it "explodes" on Pacific islands and mainlands. Let me give you a little lesson on the subject.

The storm at first is known as a vortex with counter-clockwise winds up to 35 knots. Encouraged by its progress, the young critter starts to flex its muscles and while its winds increase in velocity up to 64 knots, the weather station is busy labeling it "tropical storm."

There's no stopping here. Anxious to "go for broke," the closed circulation steps up its pace and climbs into the major league class when its velocities exceed 64 knots. The occasion is made conspicuous and historical by the weather department giving it that sinister title, "Typhoon——."

While this is going on, our boys haven't been sleeping on the job. Our aircraft have been observing every move of the youngsters, day and night. Flight crewmembers, mainly the weather observer and the weather technician, have been compiling and recording data which is sent via radio to the ground station monitoring the missions. That's where Detachment 15-2 steps into the picture.

The Andersen detachment receives this data at half-hour intervals. It evaluates and uses the information in its prognostications and in forewarning areas lying in the typhoon's path.

You can't easily measure the number of lives and dollars in property

All hands attend a special briefing. Then the aircraft commander finishes it up at Operations.

saved by these storm warnings each year. The inhabitants of islands and mainlands of the Western Pacific and Far East benefit immeasurably from them. But, the typhoon may still deal a large parcel of destruction despite advance warnings. This happened with "Louise" which struck late last year, and "Vera" which pummeled the Philippines this July.

We can write about "Louise" with a certain amount of authority. We were on the crew that christened that little gem. Hold on! Did I say "little"? That's hardly an apt description for a storm spread out over approximately a 500-mile area.

We found "Louise" waiting for a pickup just off the east side of Pacific and Mariannas intersection. It gave every promise of being one of the fiercest storms to hit these parts in many a moon and—before it died in the North Pacific—it lived up to the very worst expectations. It took a north-northwest heading and roared and snorted toward Iwo Jima. Warnings were posted and personnel on the island tied down for the big blow. Then—it struck.

Metal buildings toppled in complete surrender to the rash impact of winds over 200 miles per hour. Except for the early warning, everything on the island would have been destroyed. Somehow, Iwo managed to survive the *tai-fung* and, despite extensive damage, the runways were back in operation not long after the storm had passed.

"Louise's" appetite was whetted. The storm turned westward toward Okinawa. But when it found the island forewarned, it changed its mind and took off for Japan.

We followed it, plotting its every move, watching it while it slept, chasing it when it awoke. It smashed into Japan, but evidently the foray at Iwo had taxed its strength. Although it still managed to claim the lives of many and destroy a great deal of property, it was slowly dying. Like a warrior wounded in battle, it slowly withdrew and a short time later expired. When the final tally was in, the Typhoon Chasers had flown no less than 13 missions chasing the ole gal!

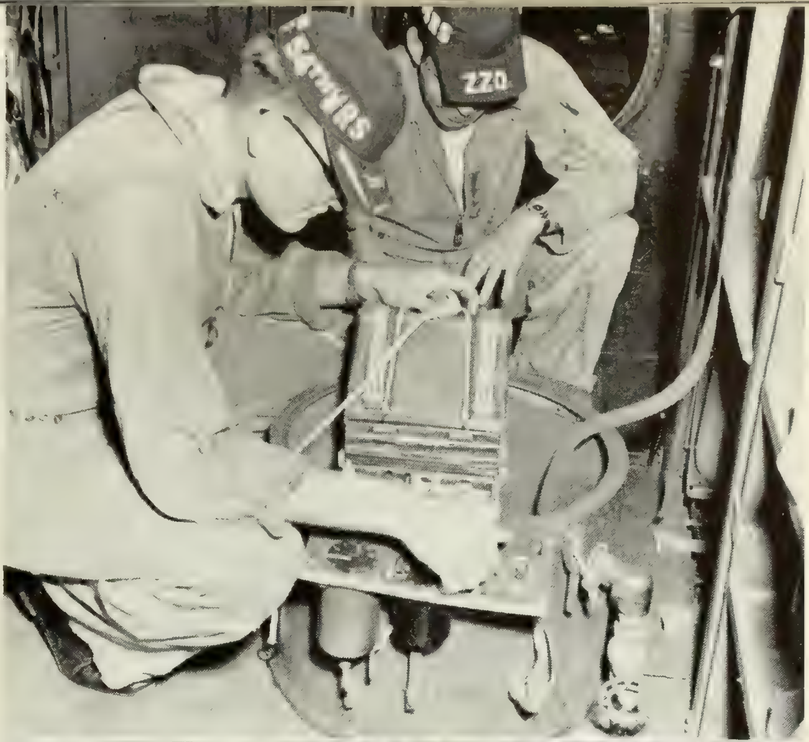
The Season

The height of the typhoon season out here generally is the period from July through October. Records from the files of the Typhoon Chasers show this to be the most prolific time of year. During our squadron's nine years on Guam, September and October have given birth to more of these storms than any other month. August follows closely behind, but then there is a definite drop. February evidently doesn't care much for the "girls," having produced a single typhoon during our stay.

These same records reveal that 1952 was a banner year with the squadron tracking 22 different typhoons. The least productive year, meanwhile, was 1949 with a repeat in 1954 when there were "only" 15 of these storms.

Sometimes the "girls" like to wander out of 15-2's area of forecast responsibility into that of Detachment 15-1 at Clark AFB. But, the 54th WRS, like a jealous suitor, tags along behind. Last year these staging crews flew 29 typhoon missions and again,

All the equipment must be operational here.



Specially trained airmen with specially built equipment get set as they near the typhoon center.

this year, staged during two of the first three *tai-fungs* striking the Western Pacific.

Try and get a weatherman to describe the causes leading to the formation of a typhoon and you will get a wry smile and a negative headshake. Fact of the matter is that many theories have been advanced, but no particular one is accepted universally. We have shown you previously how erratic these storms can be. However, most of those originating in this area follow one of four tracks.

Routes

The first route extends from a point southeast of Guam and heads northwest between Palau Islands and Ulithi Atoll and on to the Philippine Islands and the China Sea. Early this year, "Sarah" and "Thelma" took that route.

A second track is one which generally starts south of Guam. Then it moves past the island on a northwesterly heading toward Taiwan (Formosa). Sometimes, the "girls" will want to follow it into the China Sea and even beyond it to the mainland. "Iris" took a fancy to this route in August, 1955.

The third corridor begins northwest of Guam. It heads to Okinawa and then offers the "girls" one of three choices:

- One leads into the East China Sea area.
- One has a "yen" for the Yellow Sea (down, boy, down).
- One goes north towards Japan.

Not quite so complicated is the final route which starts north of Guam and extends on a northwesterly heading past Iwo Jima toward Japan, but—veers out into the open North Pacific before it hits that country. "Nora" and "Hope" preferred this corridor in 1955.

These were the courses taken in a majority of cases by these fugitives from a sunny day. But, there have been many other examples where typhoons took different courses or even circled in relatively small areas until eventually they expired. "Helen" followed the latter pattern in 1954.

Grab your flying suit, oxygen helmet and lunch and join us on one of these missions. We warn you, though, after a few hours in the storm area, you probably won't care for it. And, oh yes, bring along a "cookie" bag—just in case!

Here's the setting: It's just an hour past midnight. The only activity on the base is that of the street lights winking at each other. Well—almost! Suddenly, a car comes around the corner with a screeching sound like when rubber intermittently kisses the pavement. It comes to a halt in front of the squadron Personal Equipment building. Two men hop out of the vehicle. They're dressed in a manner to indicate that they are *not* civilians; they are not plumbers on a night call and they are not supermen—but, that they are crewmembers of the 54th reporting for a flight. . . . Dum-te-dum-dum.

And right here is when the fun stops and the deadly serious preparation for a typhoon mission begins. Did I say "begins"? Actually, it began yesterday afternoon when the crews assembled for briefing. They

Batten down the hatches, for there she blows.

sat in their chairs and listened as an operations flight commander conducted the session.

"Gentlemen, your missions for tomorrow are, first priority, 'Vulture Typhoon 0408' to coordinates——," and so on while the crews sat back and listened. In a way, it brought back memories of the days when the briefing officer said, "Gentlemen, your target for tonight is——."

You listen to the information being dished out: The weather observer explaining the winds expected to be encountered en route to the storm, the possible courses the storm might take and the terminal forecasts; the navigator with information about the flight and the briefing officer with additional flight information. Finally, the briefing ends with "That's all I have. Any questions?"

Yes, that's when all of this began. And now you're at Personal Equipment and it's early in the morning and you wish that you were back in the sack.

You help load equipment such as Mae Wests, parachutes, professional equipment, coffee jugs and so on, into the crew bus. It begins to rain—a tropical shower, phooey. If the storm center isn't too distant, maybe it's weather associated with it.

The bus goes to the flight line. The crewmembers spill out of it and settle down to completing their preflights. After the pilot has completed his walk-around inspection of the aircraft, you accompany him to base operations with the navigator and weather observer in a jeep. Then comes the weather briefing when you're brought up to date on latest developments within the storm. The pilot fills out his clearances and you return to the aircraft to complete the preflight. The maintenance personnel are already on the job to be sure the bird will get off on time and complete its mission. Their part in a successful and safe mission should not be considered lightly. Without these boys going for you, you are out of business—but good!

After the mission a farewell look at Louise.

Over an hour has elapsed since your arrival at Personal Equipment and the aircraft is at the end of the runway awaiting its clearance from the tower. This time has passed swiftly and you realize it's because of the speedy and efficient manner in which the crewmembers perform their multiple duties.

You're Off

At last you're off! The pilot points the nose of the aircraft on a heading towards the storm center. Your altitude is 1500 feet until you reach the storm area, then it's 10,000. You watch the crewmembers take care of their tasks. The excitement they feel is hidden under a mask which now and then falls, revealing the tenseness of the situation.

You begin to feel the first bit of mild turbulence. When the aircraft is 200 miles from the storm center, the navigator notifies the radio operator who makes subsequent transmissions on an "emergency" precedence.

The "road" is getting rougher. Outside the aircraft, the clouds have a dirty grey color. The radar navigator reports he has the "wall" cloud on radar. He tells the weather observer which quadrant appears to be the weakest, judging from returns on his scope. Then, the penetration begins.

Crewmembers tighten their safety belts. The weather observer, with the assistance of the navigator, guides the pilot through the "wall" cloud with his observation of surface winds, pressure tendencies, cloud formations and radar readings. The plane leaps and bucks. An air current sends it soaring to a higher altitude and then drops it just as suddenly. Your stomach muscles are taut.

The Eye

Suddenly, the glory of an early morning sky sends a shaft of sunlight into the aircraft. You breathe a sigh of relief. You're in the "eye."

The pilot circles in the storm center while the navigator takes a "fix" and the weather technician releases his dropsonde. As the dropsonde floats down to the surface, it radios coded information regarding temperature, humidity and pressure, back to the aircraft. This information is copied and transmitted back to the weather station along with other data.

Now the aircraft leaves the "eye" and prepares to "box" the storm. You soon find out this procedure involves flying to a point where surface velocities observed by the weather observer are less than 50 knots, descending to 1500 feet, and "fixing" the cardinal points where velocities drop off to 50 knots. When the operation is completed, you glance over the navigator's shoulder and see the course lines on his chart have formed a "box."

If you're lucky, you'll head home after the "box" is completed. Otherwise, you'll stay and make another penetration of the "eye." This generally is determined by the distance of the storm center from the base of operations. Regardless, you will be part of an exhausted crew stepping from the aircraft after landing; exhausted by emotional strain which such an ordeal invites; exhausted from the beating the turbulence gave you.

Maybe, now, you can understand why we're proud to be members of the 54th Weather Reconnaissance Squadron. A squadron must have something besides luck to continue adding to its flying safety mark when its aircraft and crewmembers take such a beating year in and year out.

Sure, the mark is amazing but is understandable because of the excellent maintenance measures and precautions employed to lessen the chances for accidents. A sound, active flying safety program is designed to give crewmembers and their equipment a better opportunity for survival in the never-ending battle against the forces of nature.

Who is responsible? Each and every man who has been a member of this organization in the years during which the record was set. The alertness and vigilance of these men to the hazards involved in this type of flying are commensurate with the skill they have demonstrated in doing their respective jobs.

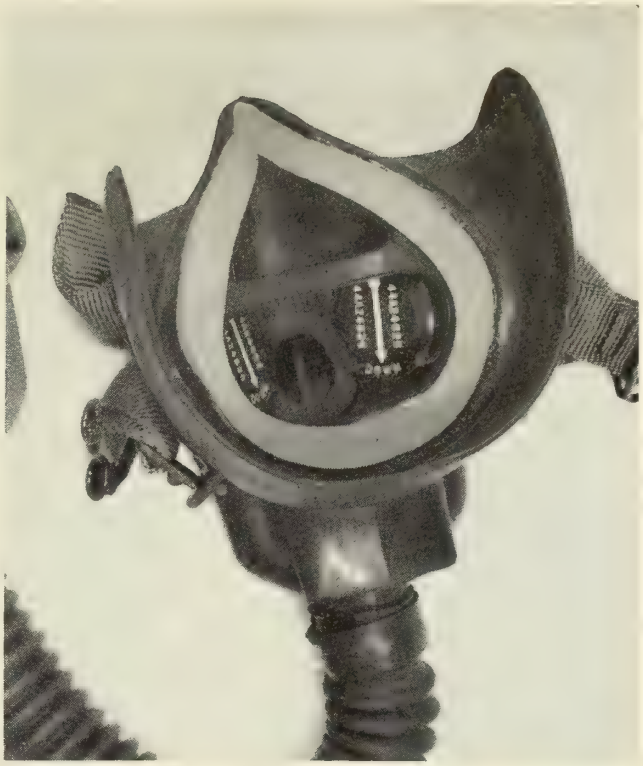
"It takes safe maintenance for safe flying. We, and those who've preceded us, have been fortunate in having both. It has been strictly a team effort all the way." ▲

Keep Kurrent

NEWS AND VIEWS

Comfortable Seal—An oxygen mask facelet insert has been developed for those who have trouble getting a good seal and a comfortable fit with the standard (MS-22001) oxygen mask. This facelet is a "V" shaped piece of "Ensolite" (sponge-like material), 1/8-inch thick. It is glued to the sealing portion of the mask. The facelet comes in a small box with glue, a brush for application and installation instructions.

WADC has conducted a service test program with Air Force personnel from TAC, SAC, ADC and APGC. This test resulted in a 92 per cent acceptance. The facelet is now standard and will soon be available to Air Force flying personnel.


Pictured here is the mask with liner glued into the proper position.

★ ★ ★

Mobile Fish Bowl—A new type mobile control tower, designed and built at McClellan AFB, is shown with a WB-50 in the background. Equipped like the main flight control tower, the emergency vehicle consists of a half-ton pickup with a specially designed van body topped by a plastic bubble, converted from a B-29 gun turret.

The mobile van has its own power source with a six, 24-volt battery stand-by system in the event of generator failure. The vehicle has a built-in CO_2 fire extinguishing system, special purpose signal and flood lights, and is air-conditioned to protect the sensitive radio equipment.

Described as the nearest to an all-purpose vehicle ever developed, it performs a variety of functions. If an aircraft crashes in the area, it leads all other ground vehicles to the scene. It can substitute for the main tower when necessary and directs aircraft in emergency operations such as the recent winter floods in northern California last year.

In cool comfort, in his air-conditioned van, traffic is controlled.

★ ★ ★

Policing Up—A monstrous vehicle that makes ordinary snow plows look like toys has been developed for the Air Force. The vehicle, an aircraft crash pusher, is intended to shovel a 40,000-pound crashed bomber off a runway in less than 20 minutes. Such an operation formerly required from five to 15 hours. The crash pusher can be used during emergency operations when an aircraft has crashed on a runway, preventing others from taking off or landing. Operating in pairs, the pushers place scoops against the crashed aircraft and literally shove it off the runway. Each vehicle weighs 150,000 pounds and is rigged with a scoop on each end for speedier operation.

The old and new. A B-52 looks down its nose at the Boeing Kaydet.

Chart

....If They Could Only Talk!

IF THE RADIO Facility Chart and In-Flight Data publication and the Special Edition RFC had deep throaty voices designed to charm the ear rather than features meant to catch the eye, they might well sing a simple melody, "There'll be some changes made." Or the standard RFC as coyly as a dame in the mood for a new facelift might remark, "In a few months, you'll be seeing the real me."

The July issue of FLYING SAFETY told you (under the title of "Same Book, New Look") of some of ACIC's plans for the Radio Facility Chart. It was too early when that story was written to tell about comments received from major air command project officers favoring the new sheet type RFC, which had been tested on the West Coast. Based on these command comments, ACIC is proceeding with more development and should have something new in the way of an RFC very early in 1957.

New Look

A prevue of this newer "New Look" shows it shaping up like this:

- Eleven small scale charts the same as those used in the Special Edition to cover the U. S., with the two supplemental area charts, Norfolk to Boston and Chicago to Pittsburgh, one side LF/MF and the other VOR. More aerodromes will be shown on the charts and the directory on the outside flap will show en route data including primary communication frequencies.
- A new planning chart about the same size as the other charts, probably a two-color job, showing LF/MF and VOR airways.
- A "beefy" In-Flight Data Booklet about 8x10. No facility charts in it, but it'll have a complete aerodrome directory in a new format which gives air/ground and tower frequencies. Although this booklet was not designed specifically for you jet types, it should be a lot easier for you to find the information you want than it was with the Special Edition.
- A new container for the charts, possibly for use in the map case. So far, the samples have been in a variety of sizes and shapes and very, very expensive.

Map Change

"A chart is a chart is a chart" to Gertrude Stein-it a bit. But there is many a change in a chart. For example, the Jet Navigation Series (JN to you) will shortly change the color of its polar grids from red to green. Reason: green shows up better under red cockpit lights.

And in case you are interested in contours (most Air Force men are, aren't they?), the JN chart has new categories in contours. Sure enough, you will find a brand new reliability note in the margin giving the following information:

Reliable contours—or accurate to within 500 feet—are shown solid contour lines with solid gradient tints. Naturally, you know what a gradient tint is, but in the event some other Joe needs his memory refreshed, a good explanation is that it's a means of showing average differences in elevation by various shades of color.

Approximate contours—which are accurate to within 1000 feet are shown by dashed contour lines with solid gradient tints.

Those accurate to within 1500 feet are shown by solid yellow contours with broken gradient tints, and those accurate to within 2000 feet are shown by broken yellow contours and broken gradient tints.

Consolan

Maybe you have used Consol while doing a hitch in the European Area.

Chatter

F. C. Redmond, Aeronautical Chart and Information Center

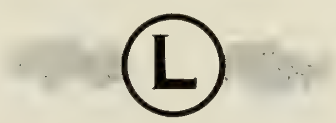
Whether you have or haven't, your chance to use a very similar thing is coming up with the installation of Consolan stations in the U. S. Two are proposed on the East Coast—one at Atlantic City and one at Nantucket, and two on the West Coast—one at Lompoc, California, and one at San Francisco. Rumor has it that the one at Atlantic City will be commissioned about the first of October and the one at Nantucket about the first of November. Thirty days before commissioning dates, they will be operating on a test basis. The ones on the West Coast will be put in later. Primary purposes of these stations, so we understand, is to assist aircraft entering the United States to locate themselves so that they can make more accurate position reports.

You don't need any new equipment in the aircraft to use this equipment, the main thing you have to do is to count a bunch of dots and dashes. But since it isn't quite as simple as that, information on the operating characteristics and use together with frequencies and locations of the stations should appear in a Military Aviation Notice correcting the Supplementary Flight Information Document, North American Area, any day now. Large sheet type charts are proposed covering these installations including reporting data for both the Eastern and Western United States. If the charts aren't ready by the time the equipment is commissioned, the dot and dash sector tables will probably be in the MAN too.

Check-In Time

If you're IFR in a jet and "drag racing" with a stiff breeze, you gotta check in at least every 200 miles and as requested by ATC whether you're on or off airways and regardless of altitude. Reporting points must be the ones you've listed in your flight plan. For these, use the compulsory ones shown in the RFC if you can.

If you're riding along in a recip engine aircraft and aren't flying airways, you must use the same procedure as listed above. (Note: It's also in the RFC; see the page opposite the inside back cover.) And if you're on airways, you get a break. Above 15,-200 feet, you don't have to check in quite as often. The RFC now uses a new symbol (watch for that L in a circle) for those reporting points which are designated as compulsory below 15,200 feet only.



Be sure to listen in every minute on the designated CAA frequency and notify the CAA before you change.

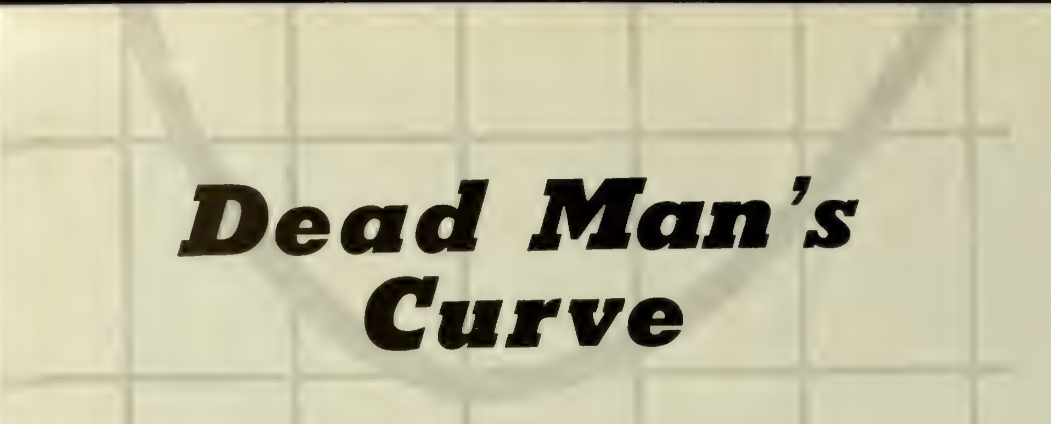
Flying High

In this vale of mangled jokes and mixed-up jive it isn't well to assume too much. And just because ATC clears you "via flight planned route" don't assume that you are approved to fly at exactly the same altitude as requested in the flight plan. The CAA has reported that some Air Force pilots seem to think so. So let's pass along a word to the wise—before you begin your "rock and roll" along that "flight planned route," get an okay from ATC on your planned altitude.

Suggestion

Take one Radio Facility Chart publication (standard book type), turn it over lightly so that the index map on the back is looking straight up at you; take one pair of shears; use two twists of the wrist so as to snip off a small triangular square from the two top corners of the two back pages (outside cover page and the page inside that). Result, you can easily find the station index for reference purposes.

A comment from an Air Force pilot states that this device is helpful to B-47 pilots who annotate their jet navigation charts with VOR frequencies as a navigational assist in certain missions. At the rate of a couple of missions per week, this takes a lot of looking-up. The perforation of RFC's so that corners can be torn off would be pretty costly, but this suggestion is one that you can try any day you happen to have a pair of shears or an old Boy Scout knife handy. ▲



Dead Man's Curve

Captain Harry J. Tyndale, 666th AC&W Sq

"GREEN TWO——I told you to go around! Take it around!" Mobile Control was transmitting and the voice was frantic.

From the front door of the Operations Building, someone yelled, "He's going to wipe him out!"

Colonel Hardy went through the crowd like a flying wedge and Captain Johnson, his Flying Safety Officer, followed. He emerged just in time to see an '86D rise from the runway and tuck up its gear. The tail of a second "Dog" was visible, standing still at approximately the point where the first one left the ground.

The entire group put up an audible sigh of relief. Closer calls may have occurred but this group of people had never seen one.

"Lieutenant, get out there and relieve the Mobile Control Officer and tell him to report to me here," and, turning to Captain Johnson, he said, "Let's go into the office."

As they passed the Ops desk, he addressed his NCOIC. "Send Lieutenant Magee in as soon as he lands."

"Yes, Sir, will do."

"All right, Campbell, what happened out there?" Colonel Hardy asked, as the Mobile Control Officer entered.

"Well, Sir, the leader blew a tire shortly after touchdown. I didn't see it 'cause I switched back to watch Number Two. When I looked back at him he was flaring for touchdown. I grabbed the mike and waved him off, but he still kept coming. I don't understand why he continued the approach. Anyway, he touched down with full power on and he made it! Boy, I don't want to see any more like that."

When Lieutenant Magee stepped through the door, he was sharp and well composed.

"Have a seat, Lieutenant," the Colonel said, "What happened out there, didn't you hear the wave off?"

"Yes, Sir, I heard it," he answered.

"Why didn't you just go around then?"

"Well, Sir," he answered, "that's what I was doing; it's just that it was marginal and I needed everything I could get."

The Colonel stood up, "It's customary to just pick up the gear and go in this outfit, Lieutenant. We take a dim view of having people do things any way they see fit. What caused you to make a touch-and-go, instead of a plain go-around?"

"I was in too deep to just pull up and go, Sir."

"You were still flying."

"Yes, Sir, I was, but only last week Captain Johnson told us about a point of no return in this bird. What he said made sense and this deal has convinced me."

"What's he talking about, Johnson?" asked Colonel Hardy.

Captain Johnson began, "I briefed a few of the boys at beer call the other night, Sir. I'd like to have Lieutenant Magee give you the complete rundown on today's situation, if you don't mind. There's no sense in my talking when we have the proof of experience sitting right here."

"Okay," said the Colonel, turning toward the Lieutenant. "Go ahead. What's the story?"

"Captain Johnson showed us exactly what this 'back side of the power curve' stuff means. We studied the airspeed and power balance at various speeds on approach. He pointed out the reasons behind many things we already know, such as, why it takes so darned much power to make a late correction. He rather surprised us by saying that there is some definite speed of commitment for each of the later aircraft. Below this speed, he said, 100 per cent will not be sufficient to permit a go-around without touching down. We agreed that a good point for decision would be the point where you begin the initial flareout. At this point you start assuming progressively higher attitudes, pulling off power and reducing speed.

"Captain Johnson drew a graph, showing the amount of drag present at various airspeeds and the amount of thrust available at these speeds. It seems that with all the garbage out, you have a very limited range of speed on the back side of the curve. The center point of the curve is the point of least drag or the speed that requires the least amount of power to hold level flight.

"In our bird, and in most other late jobs, this is the recommended approach and gliding speed for the landing configuration. Even at this speed, it takes a lot of power just to make a controlled descent. This was easy to see, since we usually come down final carrying 87 per cent, or so. He told us that you run out of power before you reach stall speed.

"Some of the boys doubted this, so the next day I went up, put the gear and flaps down, slowed to 10 knots above stall and tried to fly level with 100 per cent. I couldn't do it. I had to either give altitude or lose airspeed. I found that by flying at slower speeds, it took even greater rates of descent to hold the speed. This convinced me. If you can't hold level flight, you certainly can't break off a descent and fly away.

"It figures that if you're in a descent, with the speed and power both on the drop, the situation will get worse before it gets better. If you just pour on the coal, you may have enough to make it but it is very possible that you won't. At any rate, by holding it in the air you don't allow yourself any gravy. If you go ahead and continue the approach, you allow all of the thrust to be applied to gaining speed. Then you can get normal takeoff speed and you're on your way.

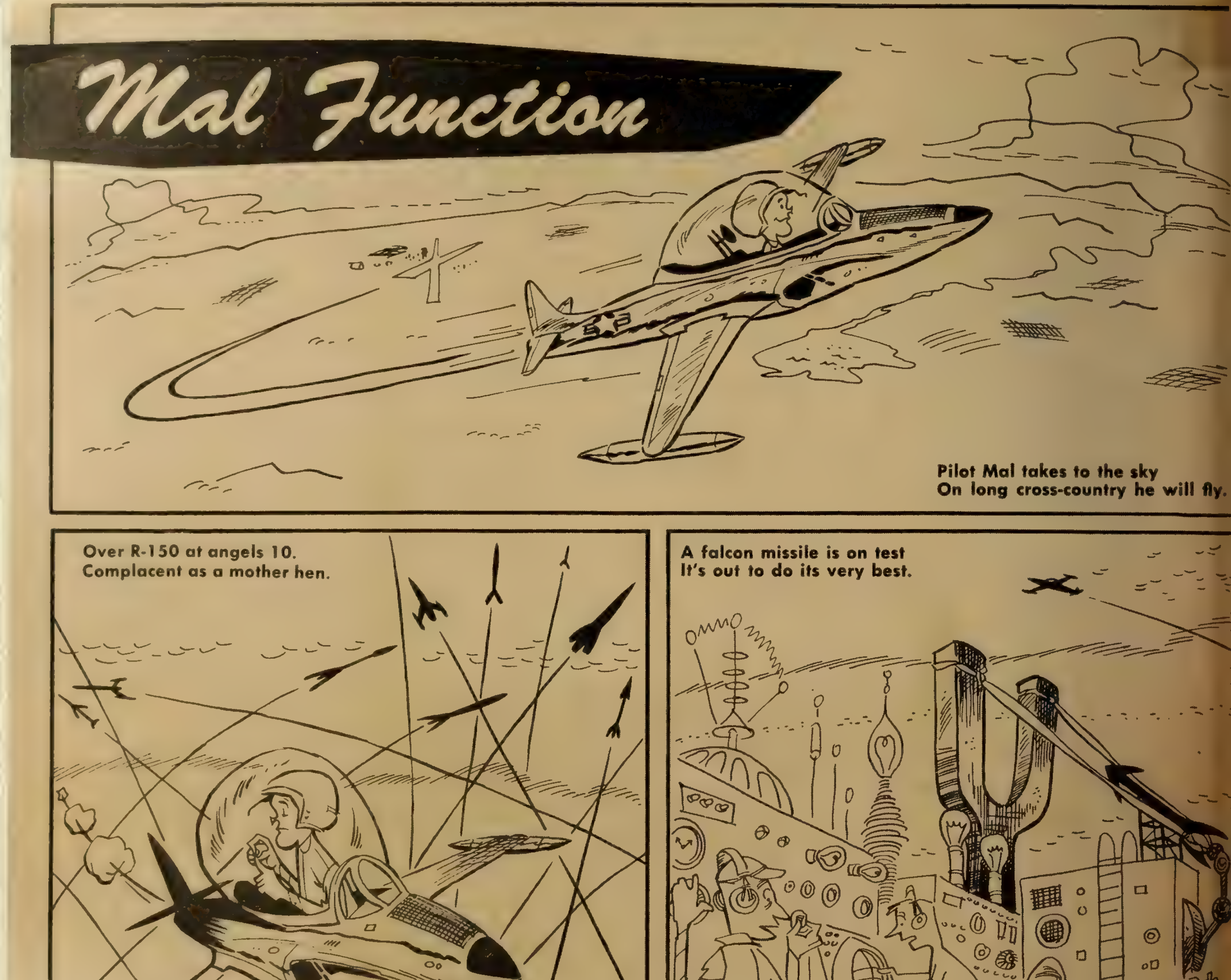
"In my case today, I was already flaring and the throttle was nearly to IDLE. I wouldn't have had a chance of staying in the air. As it was, I touched down at about the 700-foot point and used all the runway up to where Bill was. I could have staggered off sooner but I prefer a good solid speed where I have a choice. As it was, I was never in doubt."

Colonel Hardy had a very sober look on his face. "Well, there's no doubt now that it works. Johnson, can you be prepared to brief the squadron on this material by Friday?"

"Yes, Sir! I've been trying to create a demand for this for months." ▲

Hey! It's Snowing

When the alarm goes out that "it's snowing" it takes a heap of coordination, involving a multitude of units, to keep the runways operational. Remember snow removal is a big job and takes time. Take this into consideration when you clear to a destination where it is snowing.


Mal Function
Pilot Mal takes to the sky
On long cross-country he will fly.
Over R-150 at angels 10.
Complacent as a mother hen.
A falcon missile is on test
It's out to do its very best.
It seeks Mal out and proves to be
Quite deadly; any fool can see.
Don't see why Mal should feel forlorn
Because of him, new star is born.

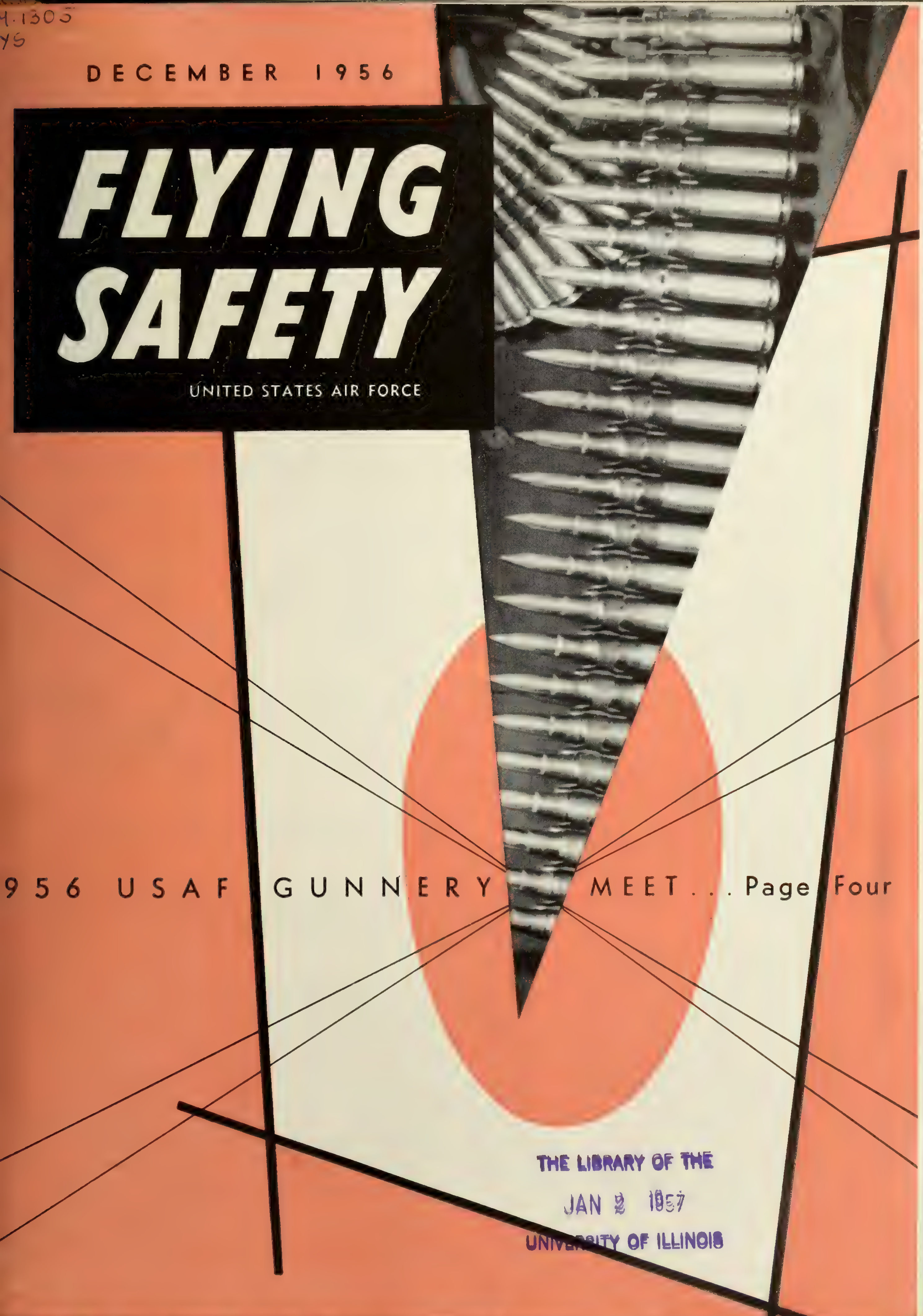
*U. S. GOVERNMENT PRINTING OFFICE . . . 402036

4.1305
Y5

DECEMBER 1956

FLYING SAFETY

UNITED STATES AIR FORCE

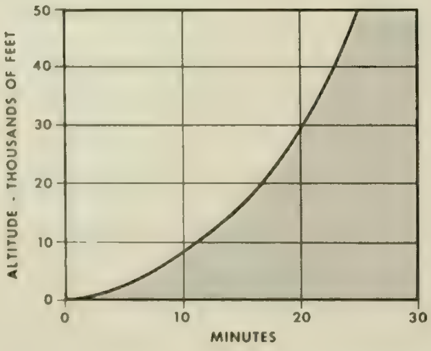


956 USAF GUNNERY MEET . . . Page Four

THE LIBRARY OF THE
JAN 2 1957
UNIVERSITY OF ILLINOIS

File Thirteen

Our cover this month is our artist's concept of the Fifth World-Wide Fighter Weapons and Gunnery Meet. It was accident-free this year and that, friends, is no small accomplishment. Read about it on page four. . . . There are still cases of getting JP-4 and 100 octane mixed up. In the latest incident, a regular JP-4 truck driver was assigned to a 100/130 truck. From force of habit, he pulled up to the JP-4 hose and proceeded to fill his gas truck with the stuff. So here we had a truck marked 100/130 filled with kerosene. He refueled a C-47 and was in the process of filling up a B-25 when the alert crew chief discovered the error. Fast footwork prevented the C-47 from trying to take off. . . On One December the Albuquerque ADIZ will be eliminated. The prohibited area around Los Alamos will remain. . . . The T.O. covering the installation of chaff in parachutes will soon hit the field. Its use, of course, is to facilitate easier radar pick-up following bailout. . . . If you want to land someplace before dark, the only safe way to do it is to determine the sunset time at your destination, then fly accordingly. For example, it may be twilight flying at 6000 feet but it is already dark on the ground. Take a look at the graph below and see for yourself. At 30,000 feet it could be daylight, while on the ground it has been dark for 20 some minutes.



Perry J. Dahl

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major V. R. Stutts

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby
T/Sgt. Chester McCubbin
T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune
A/1C Al Fagerwick
T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

Crossfeed 2
Straight Shooters' Shindig 4
Dope for Doodlers 12
Index for 1956 14
What's Next? 16
Book of Thorough Knowledge 19
The Braking Point 20
The GCA Angle 24
Rex Says 26

VOLUME TWELVE **NUMBER TWELVE**

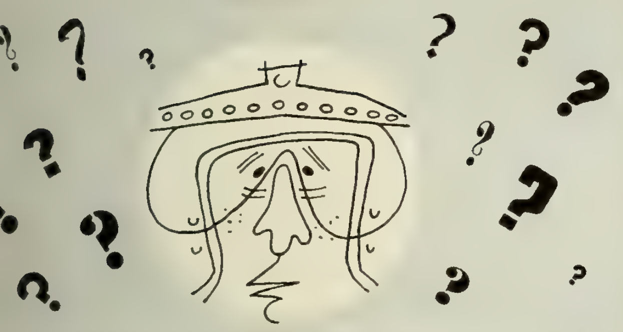
SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

How Well Can You Remember?

If you miss more than four
you had better check
those back issues.



October

1. If you clear to a base that is forecast to be clear and three or better, what are the odds that this forecast will be correct?
   (a) 50-50.
   (b) 3 to 1.
   (c) 10 to 1.
2. During pre-takeoff check in the F-102 in ambient temperature below zero the exhaust gas temperature may read as low as:
   (a) 90°C.
   (b) 120°C.
   (c) 200°C.
3. In straight and level flight your aircraft stalls at 100 kts. In a 60-degree bank requiring 2G the stalling speed is:
   (a) the same.
   (b) 105 kts.
   (c) 140 kts.
   (d) 200 kts.
4. Final approach airspeed in the KC-135 under normal landing weights is approximately:
   (a) 110 kts.
   (b) 125 kts.
   (c) 140 kts.
5. Which of the following does not apply to the new "Pilot's Handbook"?
   (a) 5 x 8 inches in size.
   (b) No obstruction will be shown along instruction approach tracks.
   (c) Aerodrome layout will be excluded.

November

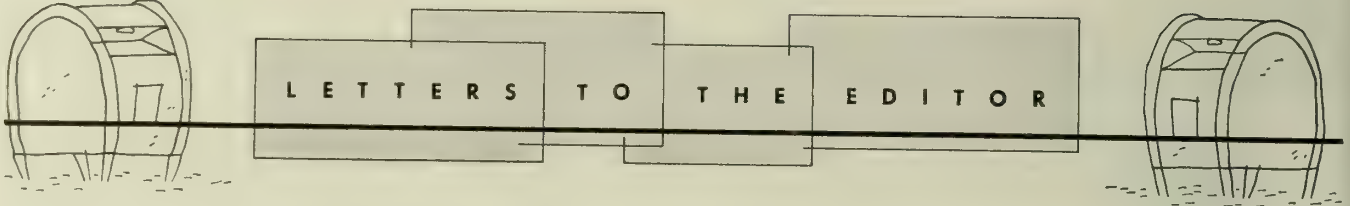
6. In the APGC "Climatic Hangar" you can test all aircraft mechanism except the guns.
   (a) True.
   (b) False.
7. The "law" on snow removal (AFR 90-6) requires that snow be removed from runway overruns to a point .... feet from the end of the runway.
   (a) 100 ft.
   (b) 500 ft.
   (c) 1000 ft.
   (d) 1500 ft.
8. Traffic pattern airspeed for the F-104 is:
   (a) 175 kts.
   (b) 200 kts.
   (c) 225 kts.
9. The F-104 can operate out of a .... foot runway:
   (a) 6000.
   (b) 7000.
   (c) 8000.
   (d) 9000.
10. Winds in a typhoon are as high as:
    (a) 150 mph.
    (b) 200 mph.
    (c) 250 mph.

December

11. You can tell if a particular GCA glide path is 2½, 3 or 3½ degrees by referring to the Radio Facility Charts.
    (a) True.
    (b) False.
12. On a 1000/on top flight you must file IFR when such flights are over a cloud cover of:
    (a) 4/10 or more.
    (b) 5/10 or more.
    (c) 6/10 or more.
    (d) 10/10.
13. The visibility minimums for ADF approaches are:
    (a) Published in the Radio Fac Chart.
    (b) Published in the Pilot's Handbook.
    (c) One mile day and two miles night.
14. On air-to-ground, low-angle strafing, firing must cease .... feet from the target:
    (a) 800 ft.
    (b) 1000 ft.
    (c) 1200 ft.
    (d) 1400 ft.
15. Tire pressure has little effect on coefficient of friction values.
    (a) True.
    (b) False.

ANSWERS

1.	(b)	6.	(b)	11.	(b)
2.	(a)	7.	(b)	12.	(c)
3.	(c)	8.	(b)	13.	(b)
4.	(b)	9.	(b)	14.	(c)
5.	(c)	10.	(b)	15.	(b)



LETTERS TO THE EDITOR

★ ★ ★

No Flashlights

The pilot is away from his home station. He expected to return during daylight but got delayed. And he forgot to bring a flashlight. Nobody'll come up with one. . . . Got to go anyway! So he goes.

If the generators don't fail, he'll get by with his oversight and violation. If they do fail, he ejects or crawls out.

Although he didn't have a flashlight, you can press a cinch bet that he had a buck or two in his pocket and would gladly have parted with a piece of it for said flashlight.

If the USAF "funders" could give each base a one-time shot of about a dozen dollars, the base ops officers could stock adequate flashlights for non-profit resale to hapless pilots. The dispatchers could be made responsible for restocking and controlling the limited funds and that six-bits flashlight just might keep some guy from pulling the handle when all goes black.

Major Wayne T. Plant
IG, 27th Air Div (Def)
Norton AFB, California

By George, not a bad idea!

★ ★ ★

Water Training

A few weeks ago I read with much interest the two articles on water survival (FLYING SAFETY, July), and remembered that in nightfighters in Korea we were told to "head for water" in case of difficulty . . . and the instructions got vague after that.

Dr. Llano's last sentences were, "Those stationed inland should not accept success in a swimming pool as a sign of proficiency; the sea is different. At night the sea and unfamiliar gear can be both different and strange."

These words jabbed me in a tender spot. The toughest water training I'd had so far was the classic leap into a calm pool to inflate the vest and climb into a raft. It had been a snap.

The question seemed to be: How can we throw the would-be water survivor into a really tight spot without risking his life? The next afternoon, accompanied by Major John Wrona, friend, pilot and parachutist, I walked up to the pool with an armful of gear. As I got into the flying suit, life vest and chute harness I thought of the trouble I'd be in in a few minutes. The situation:

Joe Doakes has bailed out and will land in water. He's been stunned; will only start operating after he's submerged. He has no dinghy. He doesn't know it but his CO_2 bottles are defective. The canopy won't quick-disconnect; he must get out of the harness. This is a heavy sea, not a mill pond. He can't see at all. It's dark, or he's blinded by a flash fire.

We held a brush-up briefing at the edge, then the Major blindfolded me and guided me out on the board. All at once the usually reassuring feel of the vest and harness seemed a little hostile with the blindfold on.

I leaped in and Major Wrona jumped in beside me. Fighting up and unbuckling the harness, I barely got to the surface when he shoved me back underwater. Up and down. Up again and down again. All according to plan but disconcerting to find my mouth full of water instead of air each time.

Now free of the chute harness, I got my hands on the oral inflation tube and it wouldn't open. Several (gasp) duckings later I realized that the mouthpiece retaining collar must be turned in the "tighten" direction to loosen it. Still blindfolded, and getting tired, I finally choked enough air into the vest to float. Off came the blindfold, and the big grin beside me said, "Had enough?" I had.

We went through the test twice more, though, and found that a little equipment trouble goes a long way in the water. Even a strong swimmer is hampered badly by clothing and malfunctioning gear. The inability to see makes familiar equipment harder to use, and may produce a degree of panic. Combine malfunction and loss of sight and the situation gets hairy, especially with the ducking.

Now consider that in an actual situation the downed airman may be a mediocre swimmer, or a non-swimmer. He won't have the reassuring pool-and-companion environment. He may not have such an ideal water temperature and he may be injured, or he may be in a state of shock. He will be wearing boots and maybe a jacket . . . and things get still tougher.

This experiment made me a believer in hard training. Sure, it was inconvenient . . . but it was sobering.

Know anyone who's complacent? Let him try this.

Lt. Dick Myers, USAF
Hq 31st Air Division
St. Paul, Minnesota

The extra attraction of having somebody shoving you under surely does add to the realism. Thanks for the tip on survival training.

★ ★ ★

Lost on Final

While working with the local AACS Detachment to solve some local problems we've come upon an item which I believe could be of importance to everyone. We were working surveillance approaches in the F-94C and were continually being lost on the final approach.

It now comes out that due to one of the intricacies of radar, the ANC/CPN-4 radar unit with Moving Target Indicator has a *blind speed*. This speed which causes a target blip to fade or completely disappear from the scope is a ground speed of 156 knots while working surveillance, and 177 knots while working precision approaches. It is important to note that this occurs while the aircraft is headed directly *toward* the antenna and that it is a *ground speed.*

In the F-94C the speed of 156 knots is right in the neighborhood of final approach speed, so it is easy to see this is a critical problem. I am sure there are other jet fighters that have a final approach speed close to this *blind speed.* When you're making a surveillance approach at this ground speed you can expect to lose contact on final and "that ain't good."

1/Lt Edwin V. Horn, USAF
97th FIS, New Castle Co Arpt
Wilmington, Delaware

As you say, "losing contact on final ain't good." It is letters like this that really get the ungarbled words around to the troops. Thanks much!

★ ★ ★

Pithy Advice

I have extracted some material from page 5 of the August issue of FLYING SAFETY and will be grateful for your permission to use it in "Air Clues" at some future date. It is a pithy piece of advice.

FLYING SAFETY is good stuff and we always look forward to it. I hope you are receiving "Air Clues" regularly; let me know if you are not. P.S. Have just heard of your devastating fire. Hope it is soon under complete control! c.h.

Flt. Lt. C. Horn, RAF
Air Ministry, DFS
Richmond Terrace
Whitehall, London, SW 1

To our British cohorts in the "let's-not-bust-'em-up" business. . . . Permission granted! We receive "Air Clues" and enjoy it very much.

P.S. The fire is out.

★ ★ ★

Experience

As I lay in traction in the base hospital with a broken back, I read Major Secor's letter in the July FLYING SAFETY. His theory is that there is no such thing as Night-VFR.

I disagree. Our night-VFR mid-air collision between two jets was pure and simple a case of not looking where you are going. In my opinion the present rules are adequate and safe. But, any rule must be complied with to serve a purpose. Restrictions and more restrictions are not the answer. It can eventually end in its own ultimate answer. Prevent all aircraft accidents by preventing all flying.

Our rules are sound and adequate. Our weakness is in compliance with the rules. Supervision, common sense, discipline are what we need. Even mandatory IFR at night will not prevent mid-air collisions if no one complies with the IFR rules.

Let's comply with the rules we have before we write more rules.

Maj. Douglas M. Montgomery, USAF
AFROTC Det 145, Florida State Univ
Tallahassee, Florida

Now this is what I call the voice of experience.

★ ★ ★

Crash-Rescue Manual

Being a Flying Safety Officer and a pilot, I am naturally interested in crash-rescue procedures. I want to know that the crash crews can get me out of my aircraft if I have difficulty whether it be at my home station or at another base.

What I would propose is a crash-rescue manual which would show emergency entrance procedures, seat and canopy safetying procedures and the like, for all aircraft which a base might come in contact with.

Perhaps this has been considered or even finalized without this base receiving a copy, but if it has not, I feel it is worth considering.

Capt. Herbert L. Byers
Perrin AFB, Texas

Your suggestion is a good one. A project is just getting under way to educate Air Force types in emergency exit procedures. Something will be out soon in the Flying Safety Officer's Kit, to be used at the accident-prevention meetings.

★ ★ ★

Bailout Trainer

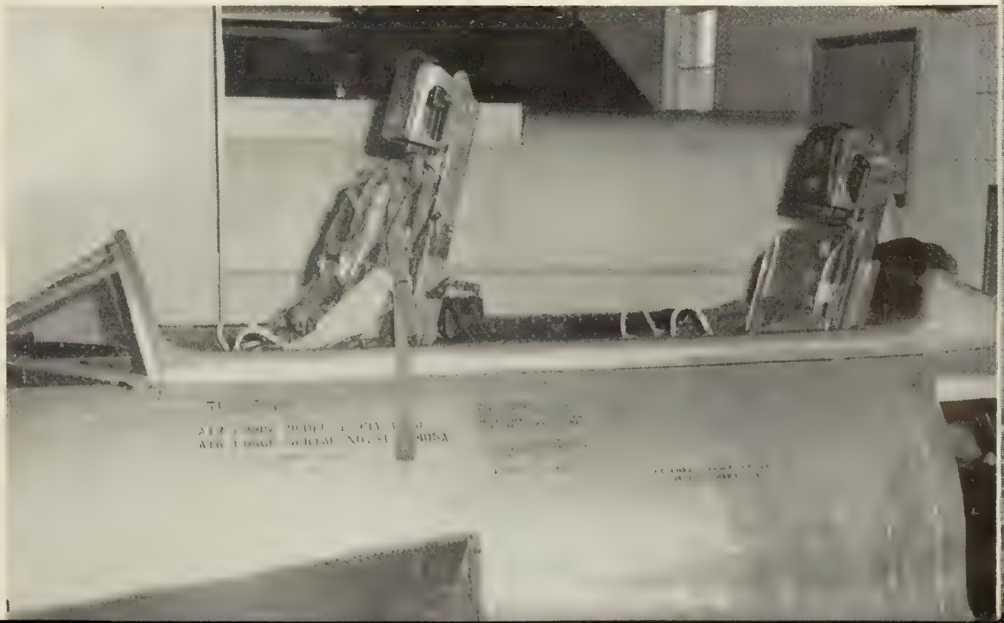
We thought FLYING SAFETY would be interested in this photograph showing cockpit procedures for the bailout trainer, set up here at Craig AFB. The idea for this project was taken to the MTU section and its personnel built the trainer. The seats operate on a bungee and only move upward about a foot and a half when the ejection trigger is pulled. However, the procedure of pulling the handles is there and we feel this gives the student knowledge of ejection that he needs.

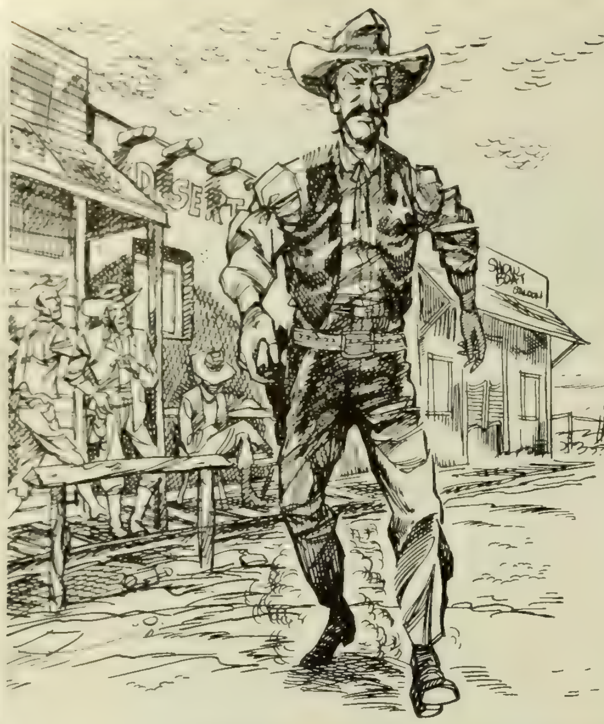
Perhaps other T-33 bases will find our idea worthwhile?

Capt. James P. McMullen
FSO, 3615th Flying Trng Wg
Craig AFB, Alabama

Real fine deal, Mac. Thanks for passing it along. I'm sure other bases will be very interested in the idea established at Craig.

The cockpit portion of a T-33 was set up for training students on correct ejection procedures.





The Fifth World-Wide Fighter Weapons and Gunnery Meet is
tory. Again it was an accident-free meet. This story is dedicate
the officers and airmen who did so much to make this poss

Sharp Shooters

With the dawn comes flight line activities.

NOT SINCE the days of Wyatt Earp has there been so much gunplay out West.

Teams from each major command shot it out with everything from .50 calibers to high velocity rockets at the Fifth World-wide Fighter Weapons and Gunnery Meet.

Phase III of the meet was the air-to-air rocket competition between all-weather interceptors. It was held at Yuma's newly christened Vincent Air Force Base, Arizona, with the Eastern Air Defense Command, from Selfridge AFB, Michigan, walking off with the top honors in this phase.

Phases I and II was the scene of the day-fighter and special weapons shoot-'em-up at Nellis Air Force Base, Nev. The winners are listed on page 11.

At Nellis, as at Yuma, the fly-safe precautions paid off. Not a single participating team was involved in an accident, and this is no small achievement. When you have such fierce competition for top gun honors, you might think flying safety sometimes takes a back seat. Actually, it's safety at its best—the built-in kind.

Shindig

Gun harmonization, a must for sharp shooters.

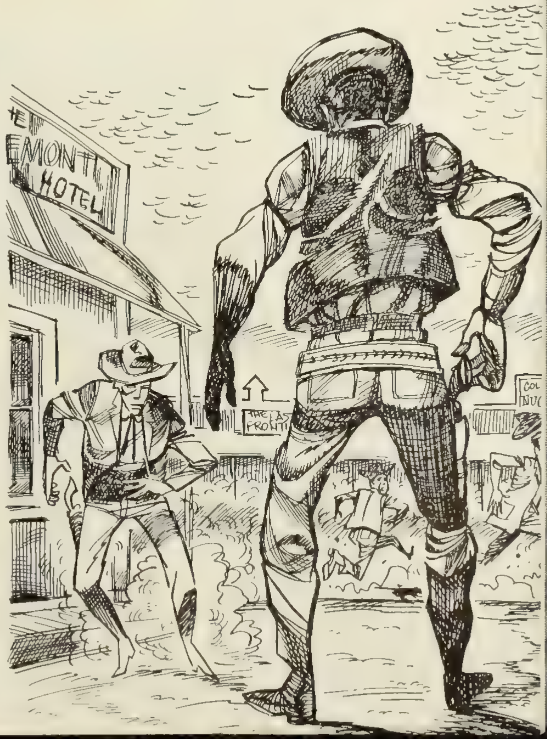
Competition for top gun honors is fierce.

The schedule of events fits into a tight timetable and every rule is directed toward keeping things going. If the schedule breaks down and crews have to rush-rush-rush, that's when ole devil "accident potential" has a ball.

But through good cooperation from team members, things at Nellis went like clockwork. Even Mother Nature contributed her bit to the flying safety effort. The weather could hardly have been better.

Although a few make-up missions always are inevitable, each team member did his utmost to comply with the schedule and the rules—rules that did so much to make this another accident-free gunnery meet.

At Nellis, each team consisted of four pilots and one spare, plus a crew of maintenance members. The number of authorized maintenance members depends on the aircraft type and ranges from 22 to 24. As always, the maintenance troops play an important part. When one of their birds gets airborne, then aborts for any reason, that team member is charged with a zero for that mission.



The main thing is that all firing should cease at the 1200-foot line. It is a safety precaution.

Actually, all five aircraft taxi out to the takeoff position. If one of the members aborts before leaving the ground, the spare can fill in.

Following takeoff, the team climbs to a prescribed altitude, depending on the mission, and flies a special corridor to the firing range. Aircraft returning from a mission, fly another course and altitude—another facet of the flying safety precautions.

Upon arrival at the firing range each aircraft is required to have an operational radio. Otherwise the pilot is not allowed to fire, and must return via the return corridor and is charged with a big zero for that sortie.

Air-to-Ground

A typical air-to-ground mission runs something like this.

Each aircraft carries 400 rounds of ammo, 100 in each of four guns, for the low angle strafing phase. The rounds are carefully checked by specially appointed armament loading judges. They also check the four practice bombs loaded aboard the aircraft.

After arrival at the range, pilots prepare for, first, the skip bomb runs, then the low-angle strafing. After checking in with the range control tower and receiving proper clearance, they take up their pattern for the skip bombing. A rectangular pattern is flown and the aircraft are spaced evenly throughout.

The bombing targets are 10 feet high and 20 feet wide. Each team member is allowed five passes to get rid of the four bombs.

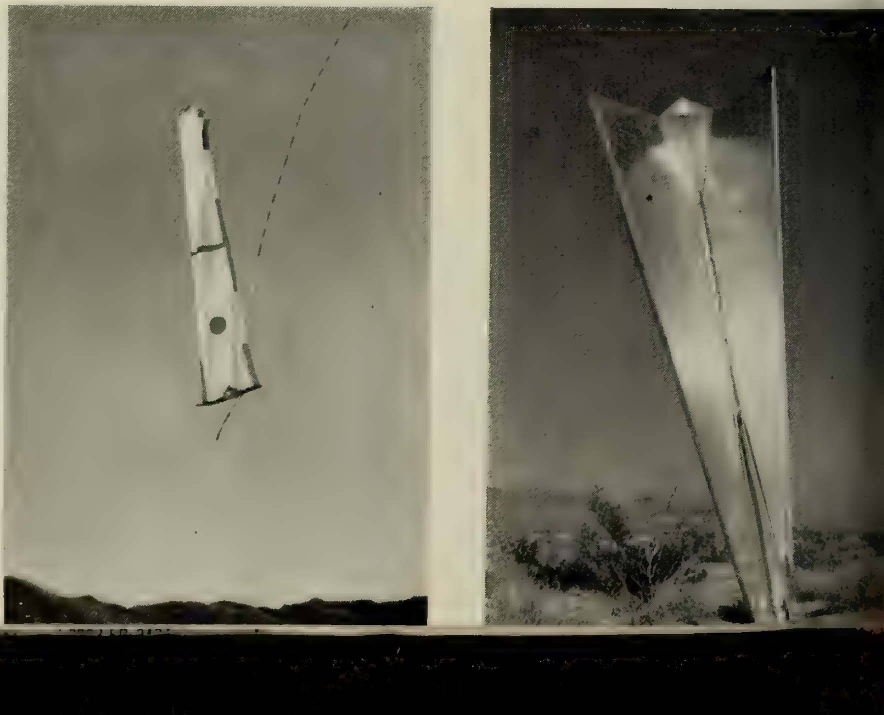
A team of judges with sighting devices are on hand to check minimum altitude violations. (RULE: At no time will an aircraft get below 35 feet.) If a violation should occur the pilot is immediately notified and he loses 10 per cent of his score. Two violations and he is disqualified from that sortie.

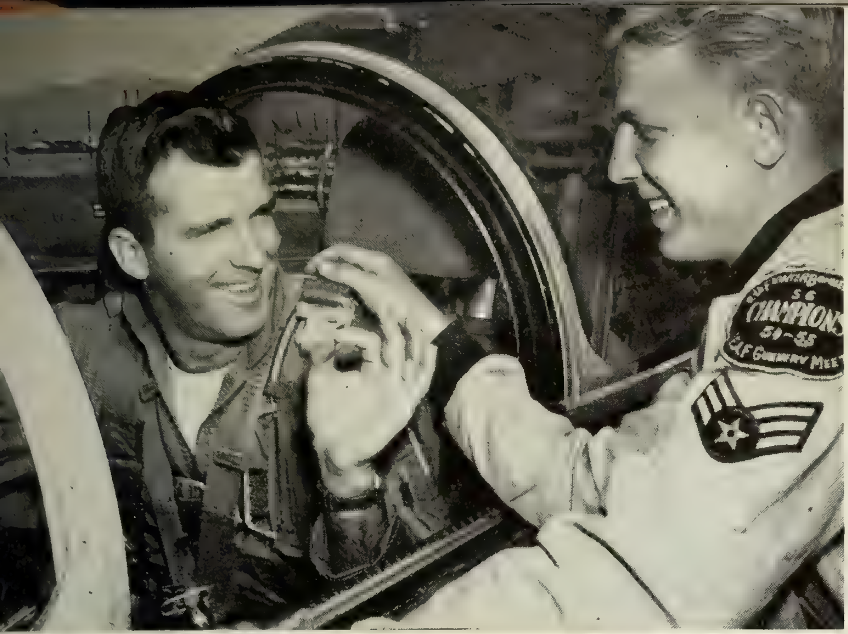
In addition to the minimum altitude requirements, judges also determine adherence to minimum airspeeds (350 kts or more). The reason for

The carrying capability of today is varied.

Pilots are skilled in many attack methods.

Left, is today's air-to-air target. The newer Dart is a solution to supersonic gunnery practice.





The strong spirit and cooperative efforts of each team member, pilot and mechanic, is evident.

Out on the range qualified judges count the hits. Hits are then marked-up on scoring board.

this minimum airspeed requirement is to prevent one team from having the advantage. Two violations here also means disqualification.

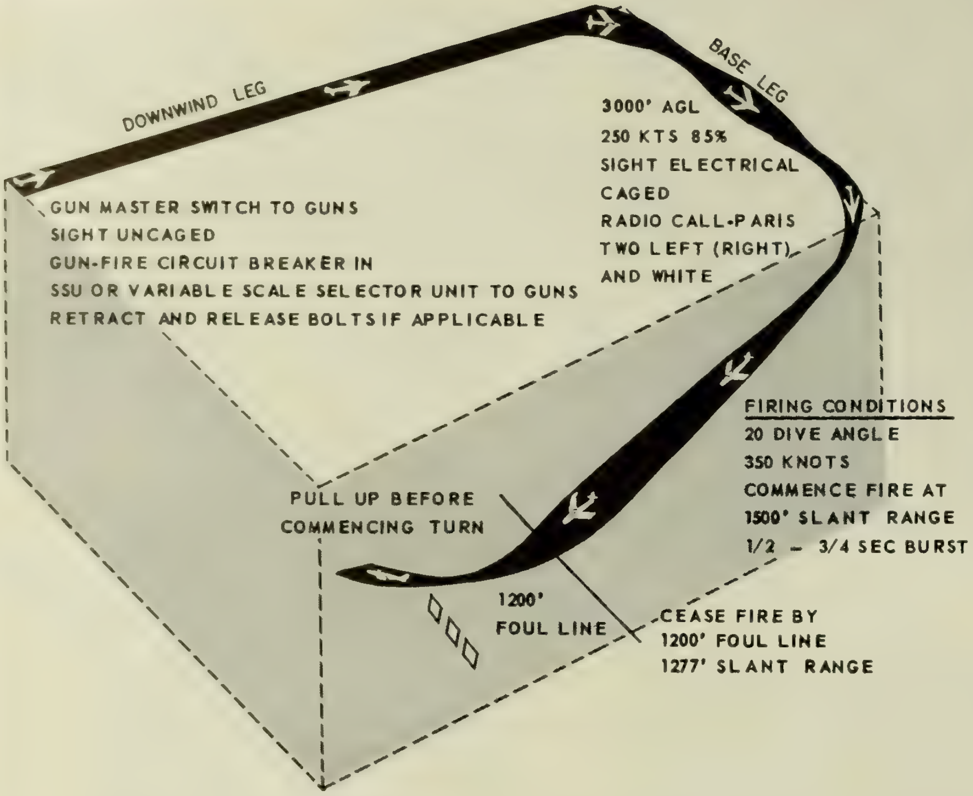
After completion of the skip bombing, the team gets set for the low-angle strafing, using 15′ x 15′ targets. On these runs the rules are simple but important. The range is set up with two foul lines. One is 800 feet from the target, the other 1200 feet. The idea is that firing should cease at the 1200-foot line, in order to eliminate the possibility of flying through the target and to reduce the possibility of damage from ricochet projectiles. The angle of attack and minimum altitude depends upon individual preference. Some come in steep while others prefer a flatter angle. The main thing is that upon reaching the 1200-foot line, the attack must be discontinued. One foul here costs 10 per cent of the score and two means a big goose egg for the mission. A single violation of the 800-foot line means immediate disqualification.

A minimum speed of 350 kts also is required for low-angle strafing.

Each pilot is allowed seven runs, with the first one being dry. There are five targets on each range and the leader may start firing on either target No. 1 or No. 5. Other team members fire on the rest in consecutive order (2, 3, 4 or 4, 3, 2).

Any ammo left in the guns is carried back to Nellis. The pilots are charged with 400 rounds total, and

Angle of attack depends on the individual.



A 1200-foot foul line is one of the safety features of the low-angle strafing traffic pattern.

Judges accurately count out the ammunition.

any ammo they carry back is lost for scoring purposes. They're charged with 400 rounds whether they shoot it out or not.

The same is true of the bombs. Any that are not dropped for any reason are still charged against that mission.

With this stipulation, not only must the pilot be a sharpshooter but the maintenance people must be well versed in gun and bomb-rack maintenance. Any malfunction can spoil a team's chances.

After clearing the range, the team returns to Nellis in formation. After flying the prescribed corridor and landing, they taxi to the cooling area. Here the ordnance is checked and the guns disarmed, under the surveillance of two judges. Just another little precaution that can mean so much.

The air-to-ground firing for dayfighters includes low-angle strafing, skip bombing, dive bombing and rocket firing.

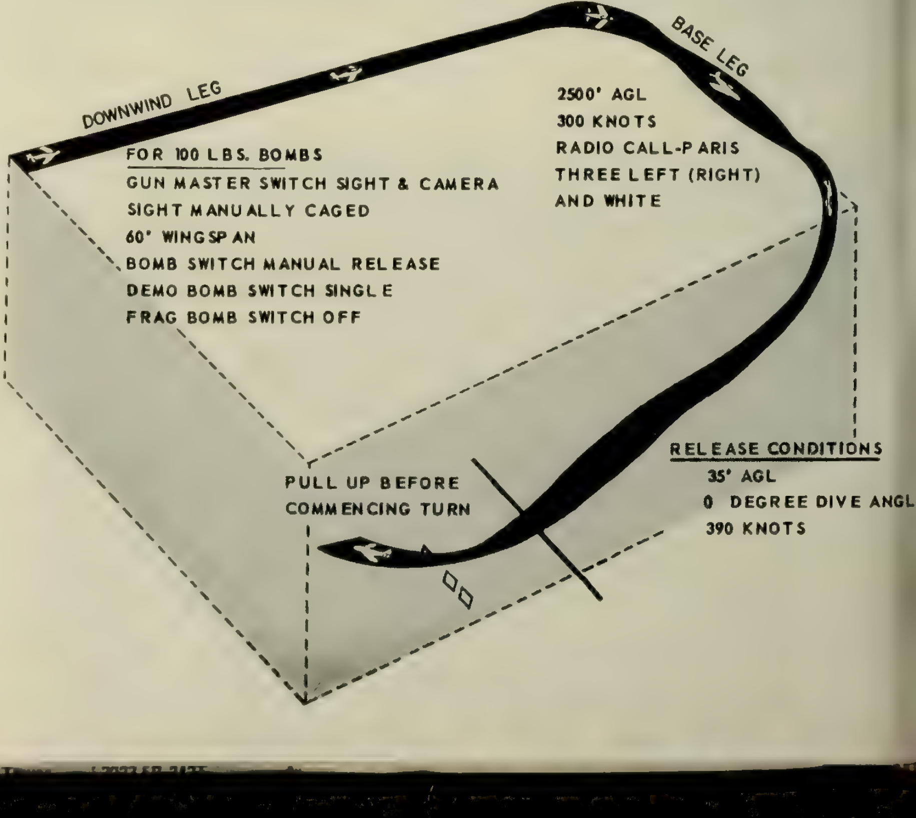
Air-to-Air

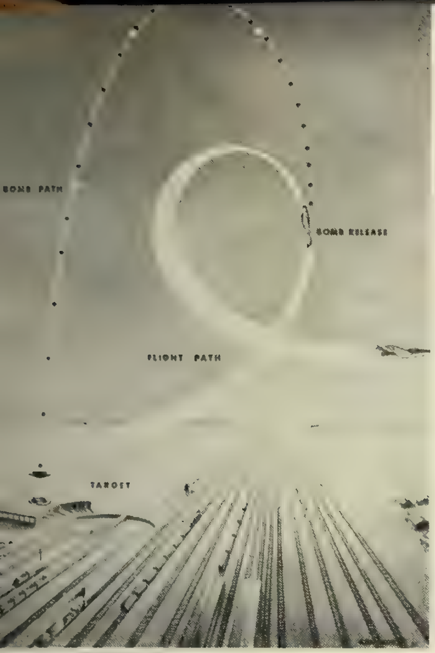
On the air-to-air competition, four guns are loaded with 100 rounds each. After takeoff the aircraft proceeds to the IP via a prescribed corridor. Firing takes place at 20,000 and 30,000 feet with four sorties for each. Judges rendezvous with the tow aircraft over a designated point to monitor the air-to-air runs. Each team member is allowed only six passes to fire his 400 rounds. They must not press the attack closer than 600 feet and the break-off angle must be in excess of 15 degrees.

The airborne judges fly 1000 feet above, 2000 feet behind and 2000 feet out from the tow aircraft's line of flight. They check target suitability, keep track of the number of passes made by each team member and notify each member when he initiates his last pass. They also notify each pilot of any fouls committed.

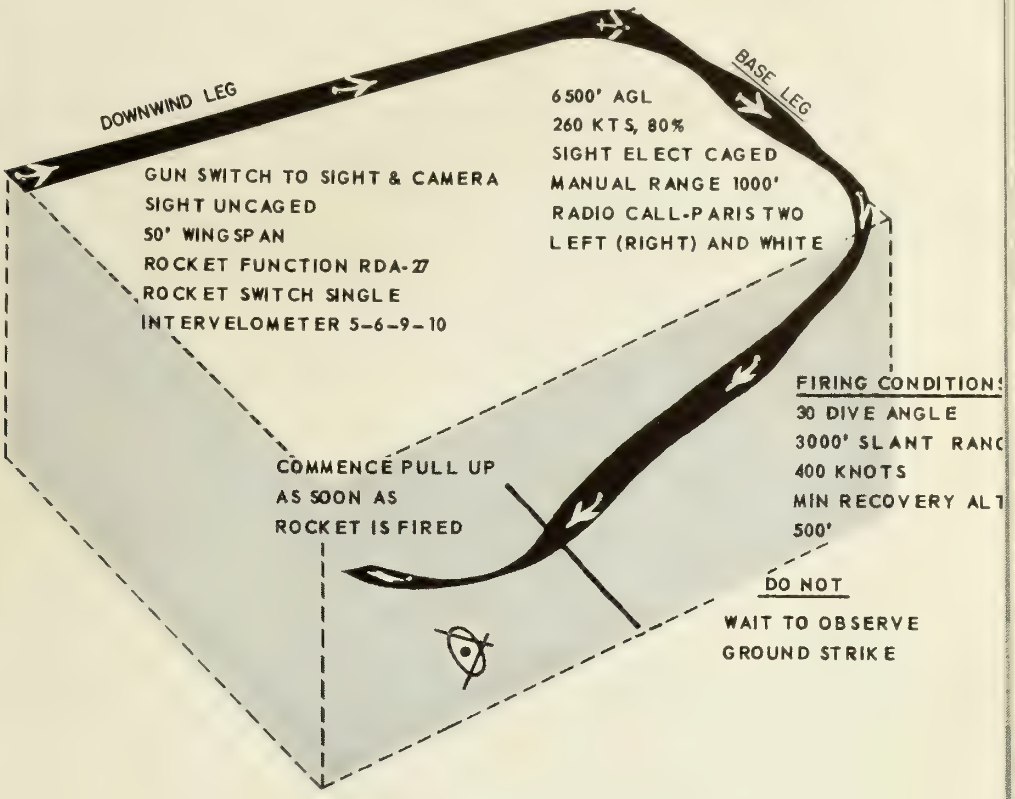
Flying at this altitude above all the activity, however, it is not always possible to spot the minimum angle fouls and/or make a firm decision on a

In the skip bombing pattern pilots must not descend below 35 feet during final bombing run.





An over-the-shoulder, special weapons pass.



Above is illustration of the typical low-angle rocketry pattern. Fouls lead to disqualification.

borderline situation. No problem here though. One look at the target in the scoring room tells one immediately whether such a foul was committed. The less the angle, the longer the hole. The rules for this event state that if ten strands of the net target are broken, a foul has been committed. A simple matter of trigonometry and arithmetic. Long hole equals foul.

F-84Fs competed with the others at Nellis.

Special Weapons

The Special Weapons (Phase II) includes low angle LABS, high angle LABS, dive bombing and a ground operation test.

The rules here, as in all the other events, are specific and any violation results in a scoring penalty.

The Wrap-Up

So far we've made it sound as if the Fighter Weapons Meet began and ended in the formal competition and the shooting-off of all the guns. Far from it. Planning for the meet began long ago—probably at the end of the last one. Definite action was started on this meet way last winter. One man observed that, "Elimination shooting for top command honors and the right to shoot at Nellis or Yuma, created, in many cases, competition that was more intense than any displayed during the finals."

There are many reasons for the "accident free" meet, in addition to the stringent rules on and off the range. The teams arrive at least a week prior to starting competitive firing and are thoroughly indoctrinated on the safety procedures. Each man knows exactly what to do from engine start to shutdown.

The air-to-ground skip bombing target is 15 feet by 15. It looks much smaller from the air.

One of ADC's F-89s in a rocket pass at Yuma.

All in all, the keynote was planning and teamwork. It was demonstrated remarkably by the hosts of the meet, the support teams, the controllers, the judges and the aircrews themselves. Needless to say, it paid off—big! The most serious happening was scratching the paint on a wingtip.

But neither the planning, the shoot-offs, the competitive firing—even the presentation of the awards was the end-product of the meet.

The Monday morning quarterbacking will continue for months to come, but the kickoff to the post-game affair came on the Monday morning following the meet. A two-day critique of the entire affair was held at the meet site. Attendance included representatives from all agencies interested in fighter weapons. There were the team captains, team members, representatives from Air Research and Development Command, Air Proving Ground Command, Air University and practically all aviation industries.

Their purpose was two-fold. First, to discuss and exchange information relative to fighter weapons delivery, training devices, techniques, range layouts, equipment requirements and new developments.

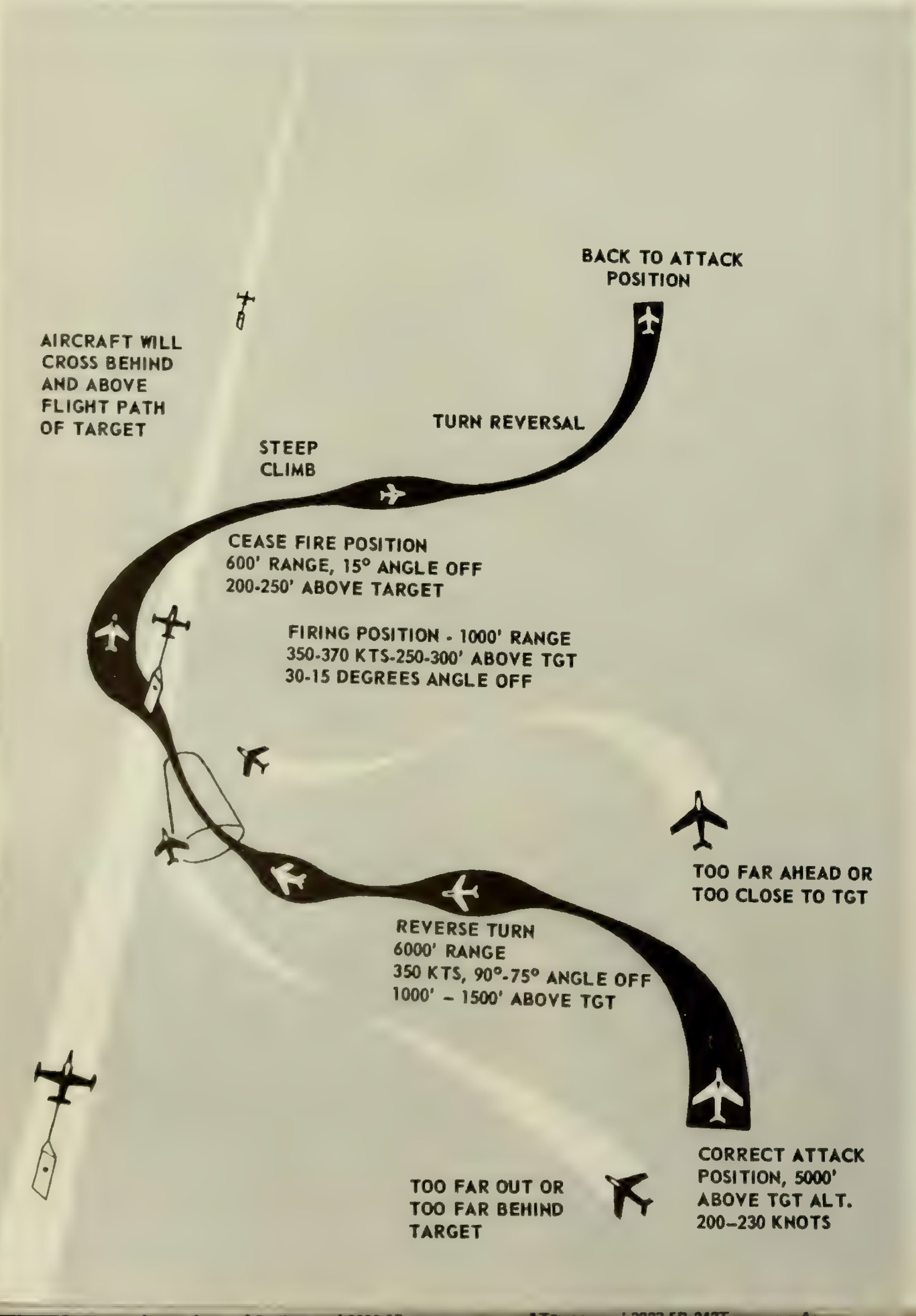
The second was to formulate recommendations for the planning and execution of future fighter weapons meets. Interested agencies should watch for the final report of this symposium. It's in the mill.

The division of the meet into three phases parallels normal combat functional designs of the aircraft. Although war remains the decisive test of combat effectiveness, the Fifth Annual Fighter Weapons and Gunnery meet provided the best available substitute. Underscoring the importance of the combat-simulated competition at this meet is the realization that decision in modern air war depends on the thoroughness of preparation.

Equally as important as a check on our combat capability is the realization that an "accident free" operation is not an accident. ▲

A special procedure was used for disarming.

Below, is the correct air-to-air firing pattern. Airborne judges on hand to assure compliance.


BACK TO ATTACK POSITION
AIRCRAFT WILL CROSS BEHIND AND ABOVE FLIGHT PATH OF TARGET
TURN REVERSAL
STEEP CLIMB
CEASE FIRE POSITION
600' RANGE, 15° ANGLE OFF
200-250' ABOVE TARGET
FIRING POSITION - 1000' RANGE
350-370 KTS-250-300' ABOVE TGT
30-15 DEGREES ANGLE OFF
TOO FAR AHEAD OR TOO CLOSE TO TGT
REVERSE TURN
6000' RANGE
350 KTS, 90°-75° ANGLE OFF
1000' – 1500' ABOVE TGT
CORRECT ATTACK POSITION, 5000' ABOVE TGT ALT.
200–230 KNOTS
TOO FAR OUT OR TOO FAR BEHIND TARGET

An air-to-air target is checked for all hits.

★ The Winners ★

PHASE I—DAY FIGHTERS

1st Place
ATC—3595th Combat Crew Training Wing (Fighter)
2nd Place
USAFE—50th Fighter Bomber Wing
3rd Place
FEAF—8th Fighter Bomber Wing

AIR-TO-GROUND

USAFE, 1st; ANG, 2nd

AIR-TO-AIR

ATC, 1st; FEAF, 2nd

OVERALL INDIVIDUAL

Capt. Asa Whitehead, ATC, 1st;
Capt. Calvin Davey, ATC, 2nd

INDIVIDUAL AIR-TO-GROUND

Capt. Asa Whitehead, ATC, 1st;
Capt. Calvin Davey, ATC, 2nd

INDIVIDUAL HIGH ANGLE ROCKETS

1st Lt. Robert Lilljedahl, FEAF, 1st;
Capt. Coleman Baker, USAFE, 2nd

INDIVIDUAL DIVE BOMB

Capt. Asa Whitehead, ATC, 1st;
Lt. Col. Chuck Yeager, USAFE, 2nd

INDIVIDUAL SKIP BOMB

Capt. Ralph Ashby, FEAF, 1st;
Captain Calvin Davey, ATC, 2nd;
Capt. Robert Pasqualicchio, USAFE, 2nd place tie

INDIVIDUAL PANEL STRAFE

Capt. Calvin Davey, ATC, 1st;
Col. Bruce Hinton, ATC, 2nd

INDIVIDUAL 30,000 FEET

Capt. Calvin Davey, ATC, 1st;
1st Lt. Tom Tapper, ATC, 2nd

INDIVIDUAL 20,000 FEET

Capt. Asa Whitehead, ATC, 1st;
Col. Bruce Hinton, ATC, 2nd

PHASE II—SPECIAL WEAPONS

1st Place
USAFE—81st Fighter Bomber Wing
2nd Place
FEAF—49th Fighter Bomber Wing
3rd Place
SAC—506th Strategic Fighter Wing

INDIVIDUAL AGGREGATE

Capt. Dee McCarter, USAFE, 1st;
Capt. William Ragon, TAC, 2nd

INDIVIDUAL HIGH ANGLE BOMB

Capt. Dee McCarter, USAFE, 1st;
Capt. Thomas Knoles, SAC, 2nd

TEAM LOW ANGLE LABS

USAFE, 1st; FEAF, 2nd

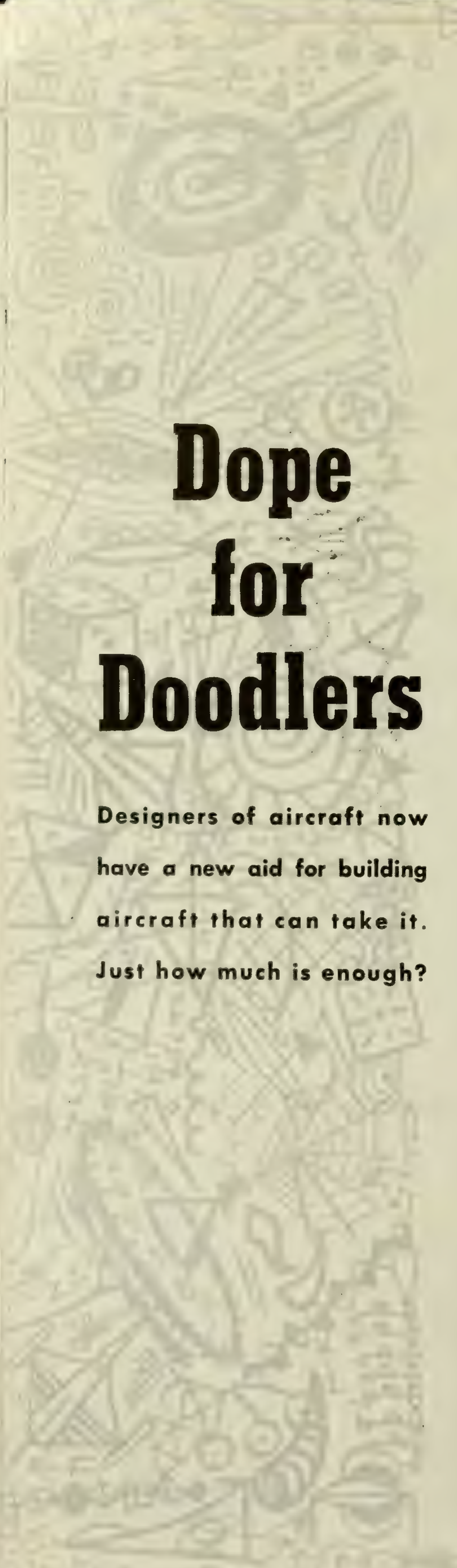
INDIVIDUAL DIVE BOMB

Col. William Chairsell, FEAF, 1st;
1st Lt. Joseph Hansard, TAC, 2nd

PHASE III—ROCKET MEET

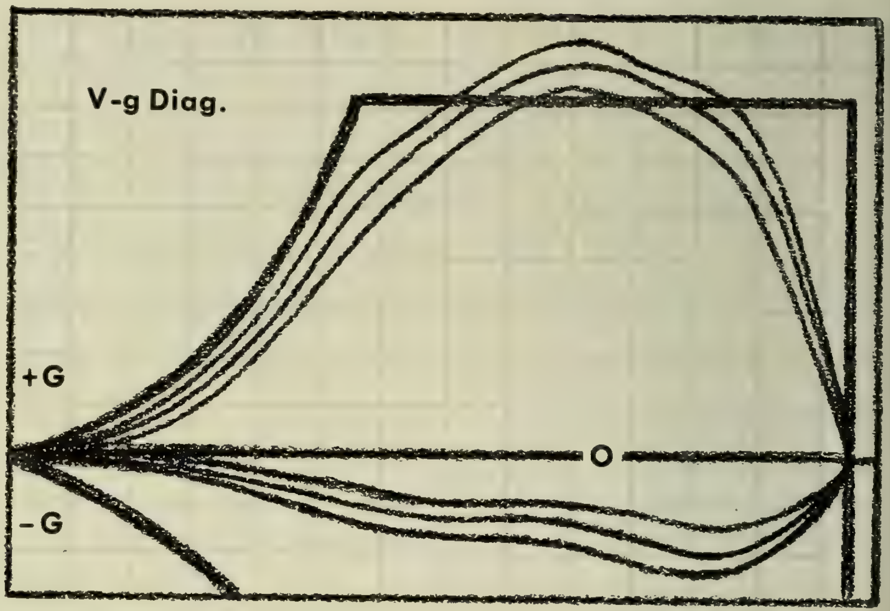
1st Place
EADF—Selfridge AFB, Michigan
2nd Place
WADF—Oxnard AFB, California
3rd Place
NEAC—Pepperrell AFB, Newfoundland

Pilots go after top scores while other members of the teams sweat it out. Maintenance crews play a very important role in winning meet.



Dope for Doodlers

Designers of aircraft now have a new aid for building aircraft that can take it. Just how much is enough?



EVER WATCH your buddy doodle while he's answering the phone? Draws airplanes, huh? You do too? Most of us do. Fantastic things, sometimes. World of tomorrow stuff. Birds we'd like to see—or fly sometime. Or maybe even the one that we fly right now. Some of us even carry this nice little bit of diversion a little farther and draw in the stuff we'd like to see hanging on the bird or place the airplane in some sort of attitude suggestive of the maneuvers that we envision ourselves performing. Touch of realism, you know.

A lot of guys make a living this way. Just sit around designing air machines all day. But here the problem gets a little more binding because this type has to put the facts and figures on his masterpiece. Ever think about that? What will it do? Obviously it is fast. You can see from the streamlined planform. And if it's that fast, it had better be strong. Plenty strong. But *how* strong?

You think 7.33G would take care of it? Or maybe 8.6? How about the one you're scheduled to fly at two o'clock this afternoon?

The little placard there on the panel says don't pull more than this many G in this bird, and that you're supposed to write it up if you exceed the limits. But can you really perform your mission and stay within those limits, or could you do better if you could use just a little more G? In other words just how good should an airplane be for you to do the job you're assigned to do?

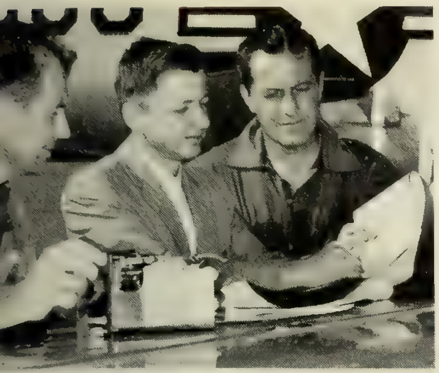
This little query has become a matter of major concern to the professional doodlers. And a little serious thought pretty well tells them that all the tests that we can run in wind tunnels and structural labs won't give them all of the answers. A little more thought tells them that all the answers will not come from the elaborate testing procedures that we put the plane through before it goes to you. What is really important is, what sort of demands are you, Joe Glotz, squadron type pilot, going to put on the machine?

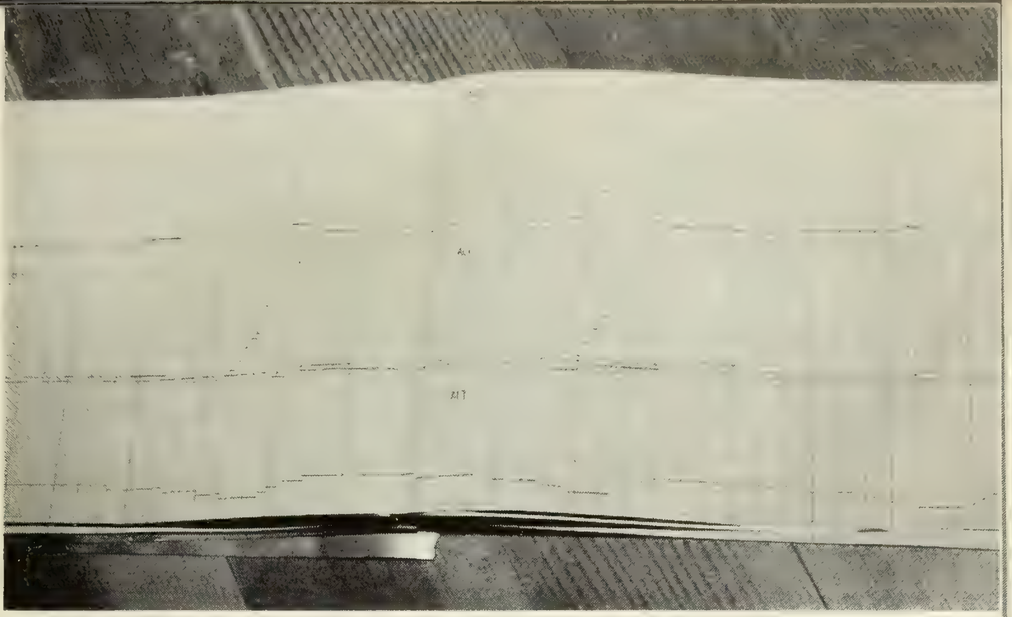
For years we've been finding out the hard way, but you sure have to pick up a lot of little pieces sometimes to get the answers that way. And sometimes those answers are not so accurate.

You guessed it. We've got a gimmick. It's that little black box in the radio compartment—or ammo compartment—or under the floor boards, or maybe even in the wheel well. Depends on what you're flying. You may or may not have seen them because they aren't on all the birds. At present there are something like 300 black boxes scattered throughout the Air Force, hooked on to all types of airplanes.

Flight Recorders

They are called Flight Recorders, and (depending on the model in use) various sorts of information is picked up by them. Some merely record airspeeds, altitudes and acceleration





Lt. Col. Yeager, left, and Col. Ascani confer with a WADC technician following a gunnery mission. The results, right, aid designers.

(G-forces). Others of a more elaborate type can record things like lift coefficient, Mach number, gust velocity, dive angles and so on. All of this is plotted on a continuous tape which rolls around at a given rate of speed and thereby gives all readings in terms of time. It will tell you exactly when you pulled 7G. Or for how many seconds during that dive you were doing this much airspeed and how long it took you to lose or gain this much altitude.

It isn't like the G meter you have installed now. It doesn't give you a false indication on landing and stuff of that sort. By the same token you can't reach down and punch off the reading. "The moving finger writes, and having writ, moves on."

Useful? This stuff is invaluable. The primary thing, of course, is to collect and analyze structural flight load data for use in formulating and /or revising structural design criteria. To do the most good, this information must come from the normal operation of aircraft that are in the field being used for their designed purpose. At least, that's the starting point. This gives us a clue on which to base our dream-planes.

But we have more. This same information can be used for revision of flight limitations on the birds we're flying, if need be. We can also use it as a basis for frequency curves, predicted V-G diagrams, gust analyses, mission studies, operational studies and fatigue cycling tests. And while it may not be necessary for you to know all this stuff to fly the bird, it is vital information for the guy who builds or tries to maintain it.

He has to have this data. From a predicted V-G diagram for instance, he could tell about how long or in what frequency (in terms of flying hours) it is going to take you to put maximum stresses on the airplane. He can foretell the time that you are going to exceed the limits of positive or negative G, and forecast the number of hours it will take for overstressing the bird due to sharp pullouts. In the end, it becomes a factor in those continued longevity pay increases—for you.

The whole idea is a concerted effort to keep the design as close as possible to the actual operational need. Faster speeds, higher altitudes, plus the ever-changing pilot techniques, airplane missions, airplane configurations and maneuvering ability demand data collected in this way to keep structural quality current.

The beautiful part of it all is that it doesn't add a thing to what a pilot normally has to do in flying his airplane. There are no instruments to watch, no buttons to push, no switches to turn on or off, nor an item added to any checklist. All you do is fly—the way you normally would.

This isn't a new program. Some of you who flew the Korean action hauled these gimmicks around in combat. And it has been going on since. To date, the people from WADC have recorded more than 31,000 hours of flight recorder time and are presently recording something like 5000 hours per year.

In last year's USAF Fighter Weapons Meet, eight of the airplanes taking part were instrumented with the Flight Recorders. The batch of data collected during the meet was the most concentrated ever recorded on operational aircraft, both in frequency and magnitude.

With all of that experience, the fellows from WADC were johnny-on-the-spot at Nellis and Vincent this year, with even more and better equipment. Planes were instrumented prior to the meet and readings were taken throughout the flying.

Example

Here's an example of how they used it. After one dive-bombing mission, a pilot looked over his bombing score and (with the aid of one of the WADC engineers) the tape from the Flight Recorder installed in his airplane. Comparing the two, he saw exactly why he had missed the target. While he was concentrating on the pipper he had allowed his altitude and airspeed to vary beyond the optimum for good bombing results.

But how do the designers use this stuff? The whole works is transferred to IBM cards and put through all sorts of statistical, computing and electronic gear. The information gathered is analyzed to predict the loads to be encountered by future aircraft in similar operations. Analyzed data are usually presented in the form of WADC Technical Notes. These are used extensively for studies by all branches of the Defense Department and by aircraft manufacturers. You can get them if you need them.

The information is valuable in the designing of gun tracking systems, autopilot systems and even the design of more efficient propellers for reciprocating engines. Perhaps stranger yet, the Flight Recorder has provided data to be used in formulating evasive maneuvers in combat.

There are a whole bunch of little black boxes that work for guys whose sole job it is to develop more dope for doodlers. ▲

FLYING SAFETY

INDEX

VOLUME 12 1956

Articles on Aircraft

Type	Title	Month	Page
B-25	The Good Old Daze	Jan	22
	Rex Says	Mar	20
	Don't Get Too Familiar	Aug	3
	Crossfeed	Sep	2
	Where Did I Goof?	Nov	22
B-26	Crossfeed	Apr	5
B-36	Look Sharp	Sep	25
B-47	Keep Kurrent	Jan	14
	Fashioned For High Living	Feb	26
	It's In The Book	Apr	12
	Keep Kurrent	June	22
	Shake Rattle and Roll	July	22
	The Forward Look	Aug	24
B-52	Keep Kurrent	Jan	14
	Keep Kurrent	Aug	15
B-57	Well Done	Feb	21
	Keep Kurrent	Aug	14
B-66	From the Ground Up	Aug	24
C-46	Rex Says	Feb	22
C-47	Rex Says	Jan	26
	Rex Says	Feb	23
	Rex Says	July	26
	Don't Get Too Familiar	Aug	3
C-54	Don't Get Too Familiar	Aug	3
C-74	Real Cool Landings	Jan	6
YC-97J	Keep Kurrent	May	15
KC-97	The Forward Look	Aug	24
C-119	Well Done	Mar	9
	It Happened One Night	July	2
C-123	Keep Kurrent	Jan	15
	Taking the IF Out of Lift	Apr	26
C-124	Real Cool Landings	Jan	7
	Rex Says	May	26
	Don't Get Too Familiar	Aug	3
	On the Surface	Sep	9
C-130	Turbo Transport	June	16
YC-131C	Keep Kurrent	Apr	14
C-133	Keep Kurrent	June	23
KC-135	Keep Kurrent	June	22
	Keep Kurrent	Aug	15
	"Casey" Goes Jet	Oct	22
RF-80	Well Done	Oct	7

Type	Title	Month	Page
F-84	Rex Says	Jan	26
	Down, Boy, Down	Feb	18
	One Two Three Bloop	Mar	14
	Shake Rattle and Roll	July	22
	Ice In the Mill	Sep	7
	Well Done	Sep	19
F-86D	Well Done	Jan	9
	George Turns Tiger	Jan	18
	Rex Specials	Jan	27
	Well Done	Apr	21
	Dead Man's Curve	Nov	28
F-86 (except D)	Down, Boy, Down	Feb	18
	Off and Running	Mar	22
	Rex Says	May	26
	Well Done	May	15
	Shake Rattle and Roll	July	22
F-89	Down, Boy, Down	Feb	18
	Well Done	June	14
	File 13	Sep	IFC
F-94	Down, Boy, Down	Feb	18
	Word For Your Bride	Sep	26
F-100	Keep Kurrent	Jan	15
	Rex Specials	Jan	27
	Rex Special	Dec	27
	Parade of the Centuries	Feb	4
	Emergency Landings	Feb	8
	Yaw and Pitch Dampers	Feb	8
	Parade of the Centuries (Spin Tests)	May	16
	Rolling the "100"	May	20
	Keep Kurrent	Oct	15
F-102	Keep Kurrent	Jan	15
	Rex Specials	Jan	27
	Parade of the Centuries	Apr	6
	The 102 . . . Below Zero	Oct	8
F-104	Keep Kurrent	May	15
	Parade of the Centuries (F-104)	Nov	10
T-33	Rex Says	Jan	28
	Look Before You Leap	Feb	1
	Rex Says	Feb	22
	Pinned Down	May	2
	Tale of the Twister	Mar	10
	Rex Says	Mar	21
	All the Way?	May	4
	Well Done	May	13
	Rex Says	May	26
	Sizzling Strips	June	24
	The Voice From Below	July	12
	Not Recommended	July	14
	Well Done	Aug	19
	Dim, Dim the Lights	Sep	2
	Keep Kurrent	Oct	14
	Know Thyself	Oct	18

Miscellaneous

OA-12	Where Did I Goof?	Nov	22
H-19	Well Done	July	11
H-21	Keep Kurrent	June	23
YH-16A	Keep Kurrent	Feb	15
X-2	Keep Kurrent	Feb	14
XV-1	Keep Kurrent	Mar	13
	Keep Kurrent	Oct	14
L-20	Know Thyself	Oct	19
T-37	Knee High to a T-37	Sep	20
Fokker Jet Trainer	Keep Kurrent	Feb	14
Spirit of St. Louis	Keep Kurrent	May	15

FLYING SAFETY Annual Index, Volume 12, 1956—Aircraft General

AIRCRAFT—GENERAL

Title	Month	Page
Look Before You Leap	Feb	1
You and Pitch Dampers	Feb	11
One Two Three Bloop	Mar	14
Off and Running	Mar	22
Sounds Good	May	2
You From the Same Mold	June	2
Get 'Em Down	July	1
Shake, Rattle and Roll	July	22
Don't Get Too Familiar	Aug	2
Runway Check Point	Aug	20
The Forward Look	Aug	24
Rex Says	Aug	27
On the Surface	Sep	9
Oops, Wrong Switch	Sep	14
The Sage of G's George	Oct	20
Dead Man's Curve	Nov	28
The Braking Point	Dec	20

COCKPITS

Title	Month	Page
George Turns Tiger	Jan	18
Hands Off	Apr	15
Death By Diversion	June	12
Dim, Dim the Lights	Sep	2
Oops, Wrong Switch	Sep	14

DESIGNS, AIRCRAFT

Title	Month	Page
Flying Submarine	Apr	14
Hmmmm Hmmmm Hmmmm	May	14
Rex Says	May	26
Death By Diversion	Jan	12
The Forward Look	Aug	24
Oops, Wrong Switch	Sep	14
"Casey" Goes Jet	Oct	22
Parade of the Centuries (F-104)	Nov	10
Dope for Doodlers	Dec	12

ENGINES AND PROPS

Title	Month	Page
Turbo Transport—(C-130)	June	16
Ice In the Mill—(C-124)	Sep	6
Knee High to a— —(T-37)	Sep	20
Intake Hazard—(F-86A)	Oct	1
The 102 Below Zero—(F-102)	Oct	8

FACILITIES

Title	Month	Page
It's a Bull's Eye	Feb	3
For Low and Slow	Feb	3
New Console	Mar	13
Marker Authority	Apr	5
Mighty Hard Paint	May	2
Jolly Well	May	3
All the Way?	May	4
Sizzling Strips	Jan	24
Drip Blip	June	26
Round and Round You Go	June	28
The Voice From Below	July	12
Self Service WX	July	21
Help!	July	24
Yak-yak-yak-yak	Aug	12
Runway Check Point	Aug	20
Rex Says	Aug	26
Plain Old Socks	Sep	3
Better Paint Job	Sep	3
Runway Markers	Oct	IFC
Flight Service Shift	Oct	15
When the Whistle Blows	Nov	7
Mobile Fish Bowl	Nov	24
Policing Up	Nov	24
The GCA Angle	Dec	24

HAZARDS—WEATHER

Title	Month	Page
Real, Cool Landings	Jan	2
Rex Says	Jan	26
Bouncing Thru the Boondocks	Mar	4
Tale of the Twister	Mar	10
High Signs	Mar	26
Lucky 13	Mar	28
Change Without Notice	Apr	16
New Flying Saucers?	May	14
Sound Off	May	28
Let's Summerize	June	8
Sizzling Strips	June	24
Rex Says	July	26
Rex Says	July	27
Rex Says	Aug	26
Plain Old Socks	Sep	3
Look Right	Sep	3
Winter Weather Hazards	Sep	4
More On Wind Shear	Oct	1
Weather or Not	Oct	2
When the Whistle Blows	Nov	7
Tai-Fung Chasers	Nov	20

INSTRUMENTS

Title	Month	Page
Rex Special	Jan	27
OMNI Tips	Feb	2
Taking the IF Out of Lift	Apr	26
Flow Gently	May	2
To Further Flying Safety	Aug	1

LANDINGS

Title	Month	Page
Real Cool Landings	Jan	2
What Are The Odds?	Jan	16
Emergency Landings	Feb	8
Down, Boy, Down	Feb	16
Bouncing Thru the Boondocks	Mar	4
Get 'Em Down	July	1
Shake, Rattle and Roll	July	22
From the Ground Up (B-66)	Aug	6

MISCELLANEOUS

Title	Month	Page
Fire Simulator	Jan	14
Well Done Awards	Feb	2
Alphabet Soup	Mar	13
Flight Safety Awards	Apr	1
In the Dark	Apr	5
S-M-A-R-T	Apr	15
In Recognition of	June	7
Just a Stooge	July	27
Call Me Scrooge	July	27
What 10,000 mph Looks Like	Aug	15
Word for Your Bride	Sep	26
Flight Safety Awards	Nov	1
Baby, It's Cold Inside	Nov	4
Sharp Shooters' Shindig	Dec	4

NAVIGATION AND NAVAIDS

Title	Month	Page
Ozone Expediter	Jan	10
George Turns Tiger	Jan	18
The Good Old Daze	Jan	22
OMNI Tips	Feb	2
Automatic Computor	Mar	13
Rex Says	Mar	20
Rex Says	Mar	21
Rex Special	Mar	21
Airways Flying	Apr	5
Fly Right	May	3
Who Dat Man?	May	9
Automatic Traffic Control	May	14
Near Misses	July	1
It Works on 75 Megacycles	July	26

PERSONAL EQUIPMENT

Title	Month	Page
Calling All Cars	Feb	14
Fashioned For High Living	Feb	24
Rex Says	Mar	20
Low Blow	Apr	25
Where's the Bottle	May	3
Riser Sharp	May	22
Rex Says	May	26
Rex Says	May	26
New Altitude Test Chamber	June	23
It Happened One Night	July	2
Survivalry, The Art of	July	6
Automatic Mae West	Aug	14
Rex Says	Aug	27
The Penlight	Sep	3
Help Wanted	Oct	1
Comfortable Seal	Nov	24

PILOT—CONDITION, REACTION

Title	Month	Page
What Are the Odds?	Jan	16
Nothing Can Be Dangerous	Mar	16
To Err Is Human	Apr	2
Everyone Loves a Fat Man	Apr	23
Low Blow	Apr	25
Where's the Bottle	May	3
You—From the Same Mold	June	2
Survivalry, The Art of	July	6
Speak!	Aug	16
Rex Says	Aug	26
Rex Says	Aug	26
Look Sharp	Sep	25
Know Thyself	Oct	16

PUBLICATIONS

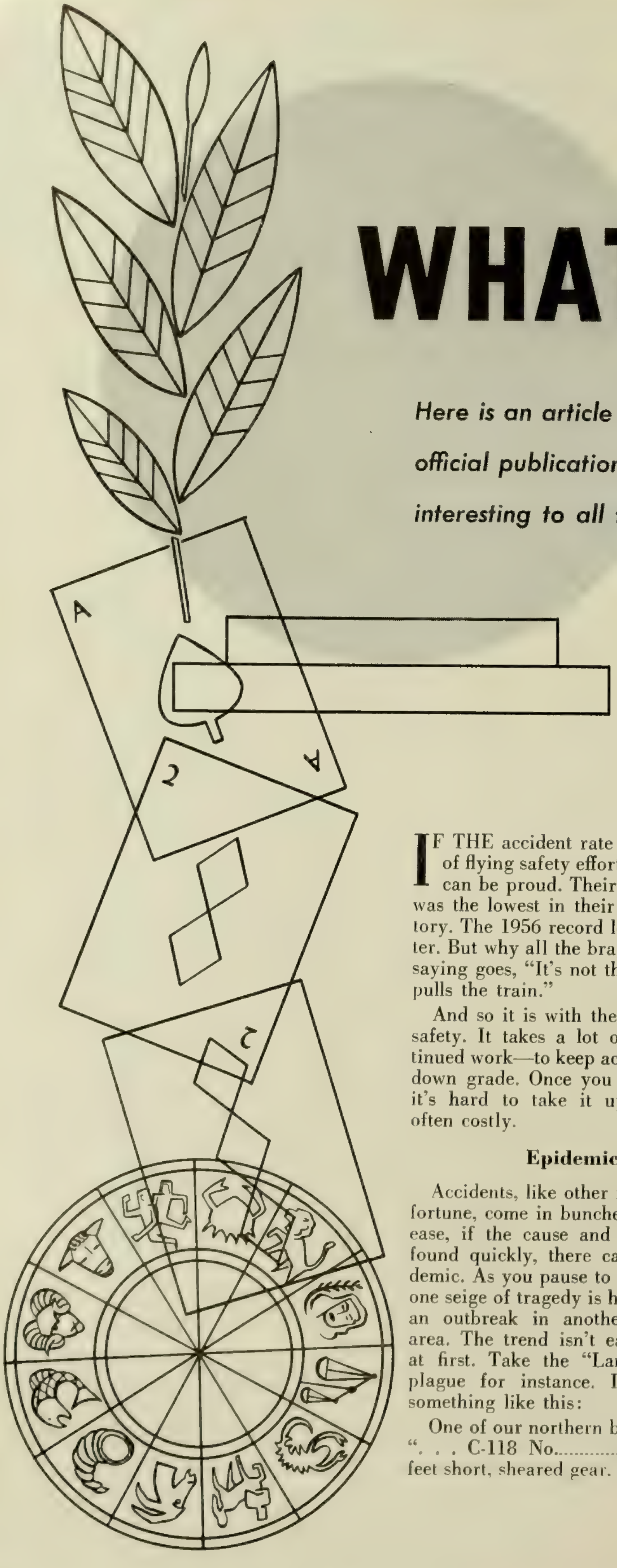
Title	Month	Page
Lucky 13	Mar	28
It's In the Book	Apr	12
The New Trim Look	May	10
Same Book, New Look	July	16
No Strange Fields	Aug	28
The Down-To-Earth Approach	Oct	26
Chart Chatter	Nov	26

SAFETY, FLYING

Title	Month	Page
Safety—A Product of Supervision	Jan	2
What Are the Odds	Jan	16
The Good Old Daze	Jan	22
A Roll of the Dice	Jan	24
Rex Says	Jan	26
Pole With a Purpose	Jan	IBC
Rex Says	Feb	22
Safety—A Product of Proficiency	Mar	2
To Err Is Human	Apr	2
Low Blow	Apr	25
The Professional Approach	May	24
In Recognition of—	June	7
Help!	July	24
See You Tomorrow, Sarge	July	28
Don't Get Too Familiar	Aug	2
Yak-yak-yak-yak	Aug	12
Commander at Work	Sep	2
Food For Thought	Sep	2
The Penlight	Sep	3
Look Sharp	Sep	25
Know Thyself	Oct	16
Where Did I Goof?	Nov	16
What's Next?	Dec	16

SURVIVAL

Title	Month	Page
Real Cool Landings	Jan	2
Calling All Cars	Feb	14
Fashioned For High Living	Feb	24
It Happened One Night	July	2
Survivalry, The Art of	July	6
Water Training	Dec	2



WHAT'S NEXT?

Here is an article reprinted from the MATS Flyer, their official publication. It is on a subject that should prove interesting to all those who fly Uncle Sugar's aircraft.

IF THE accident rate is a yardstick of flying safety efforts, then MATS can be proud. Their rate for 1955 was the lowest in their 7½-year history. The 1956 record looks even better. But why all the bragging? As the saying goes, "It's not the whistle that pulls the train."

And so it is with the job of flying safety. It takes a lot of work—continued work—to keep accidents on the down grade. Once you let out slack, it's hard to take it up again, and often costly.

Epidemic

Accidents, like other forms of misfortune, come in bunches. Like a disease, if the cause and cure are not found quickly, there can be an epidemic. As you pause to regroup after one seige of tragedy is halted, there is an outbreak in another unguarded area. The trend isn't easily detected at first. Take the "Landing Short" plague for instance. It all started something like this:

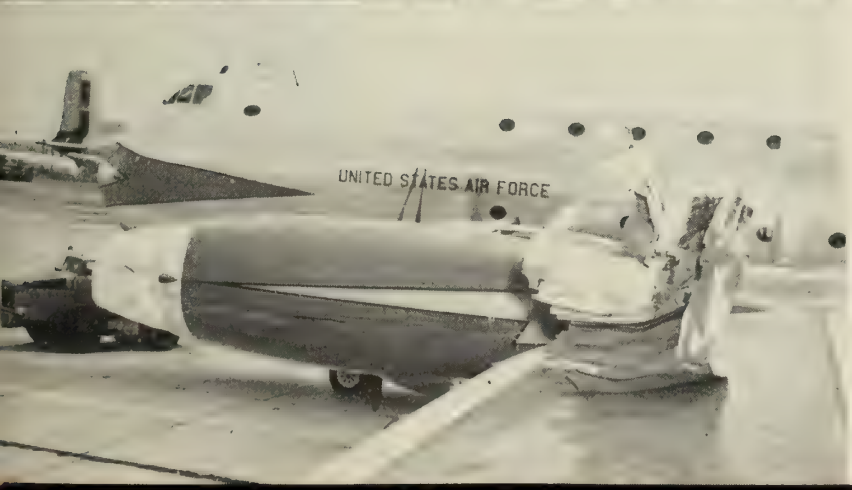
One of our northern bases reported ". . . C-118 No............ landed 200 feet short, sheared gear, bounced onto runway and burned. . . ." Within three weeks the Far East was heard from. ". . . C-124 No. .... landed short . . . hit sea wall . . . wrinkled all four engine nacelles and right wing. . . ." Then things were quiet for a couple of months.

Suddenly the epidemic hit. One "Landing Short" accident report came in every 30 days for the next four months. Within a 24-month period MATS pilots had stubbed their toes short of the runway 20 times, doing major damage to as many aircraft. The epidemic was on.

Then came the cure. The first approach was to make every pilot aware of the problem. Cockpit procedures were reviewed and changed where necessary. Power, airspeed, aircraft attitude and altitude requirements were altered to minimize the possibility of a short landing. By the end of May 1955 "cures" were in effect and the results were gratifying.

Within the last 12 months only three short landings have occurred, and one of these was under emergency conditions — quite a contrast from the previous 12 months wherein

All sorts of accident causes — landing short, collision and landing long. It's good to be able to get a headstart on a problem. Maybe we will be able soon to say that THIS is next.



eight aircraft fell victims to the landing short malady.

On the heels of the landing short problem came a new and weird tribulation: *Mountain Crashes.* Nine MATS aircraft were scattered among the peaks of the world in 1955. The same general attack was followed as in the landing short epidemic. First the question, "Why?" The primary reason seemed to be the effort of pilots to mix (or try to mix) VFR with IFR.

This deadly trouble area seemed inconceivable! It was like an epidemic of smallpox, a disease of the dark ages, breaking out today.

It didn't seem possible that nine aircraft commanders, with an average of over 4000 flying hours each would take chances with stuffed clouds. But facts are facts. The campaign was primarily one of education and admonition. This was the cure.

The reward in this case also has been gratifying—the "Mountain versus Aircraft" reports have been zero thus far in 1956.

Do we have any economists in the crowd? There are many theories on the reason for our business cycles. One is that the sun spots, which give an average periodicity of some 11 to 13 years, have important effects upon the weather. This affects crops. Good crops cause low incomes and bad business, or is it the other way round?

But beyond a doubt, in the flying business, weather can have its effect on the accident rate. For instance: In 1952 during January, February, March and April (our winter months) we crumbled 72 MATS aircraft. It's a known fact you cannot change the weather. *But you can prepare for it.* So that was the plan . . . prepare the crews both mentally and physically for these cold, gloomy months.

Wires and letters went out in the fall of 1952 with warnings of the coming winter's accident potential. The previous winter's infamous record was quoted as a reminder of what can, but must not happen again.

When the snows melted in the spring of 1953 there was reason for every airman in MATS to be proud, for in contrast to '52's record of 72 accidents, they had only 19.

The cure was simple yet effective. Aircrews and ground crews were made aware of the impending problems associated with winter and remained cautious and alert.

Probably the most surprising and exasperating of all our epidemics is the recent reluctance of pilots to lower their gear before landing. Five MATS accidents this year have been stamped "gear up."

It's a well known fact that every MATS pilot knows *how* to lower his gear; however, a few seem to forget exactly *when.*

Like to hear the most pathetic statement of the year? "As I heard a scraping sound I pushed the gear handle down. . . ." It looks like this will be another "Wake the town and tell the people" campaign.

Here are a couple of "Don'ts" that might prevent a skid landing in your squadron:

- Don't nullify the gear warning system by covering the gear warning light and silencing the horn.
- Don't over-concentrate on a minor mechanical difficulty at the expense of routine procedures.

An additional mechanical gear warning system is being tested at Travis AFB on a C-97. It is rigged so that if you lower more than 66 per cent flaps and the gear is up, the warning horn will sound. The conventional throttle warning system will still remain in effect.

But no matter how many warning gadgets engineers install, a complacent, careless pilot can always find a way to foul up the whole system.

And so it goes. As the trouble areas pop up, the struggle begins and the gap is plugged. Reducing accidents is like squeezing a balloon. As you press inward from all sides in an effort to reduce its size, it suddenly pops out as a blister in a weak spot between your fingers. If the blister is allowed to expand the balloon will burst—the whole operation will collapse.

As in the balloon analogy, accidents also will "pop out" in the system's weakest point.

It takes a lot of foresight and hindsight to spot the weakness. If you can discover it soon enough, the first accident won't happen. The man with this ability is a bona fide earn-your-pay accident prevention expert. He's worth his weight in per diem vouchers.

Have you ever heard of Janus of Greek mythology? What a safety man he would have made! You see, he had two faces; one to look forward, the other to look backward. History can foretell the future.

Clues

Many of our accident epidemics gave clues to their tragic potential months before the proverbial dam broke. You don't have to be a Sherlock Holmes or a psychologist to see the indications ahead of time.

Sometimes it's difficult to figure where the next blow will be struck. Often the clues stand out like a sore thumb. However, a complacent "it can't happen here" attitude can cover a multitude of clues.

The Trojans of old learned the hard way about complacency. Keep a watchful "fly safe" eye and be ready to toss out any strange wooden horses that may try to sneak onto your base.

Here are a few super safety-sleuth tips:

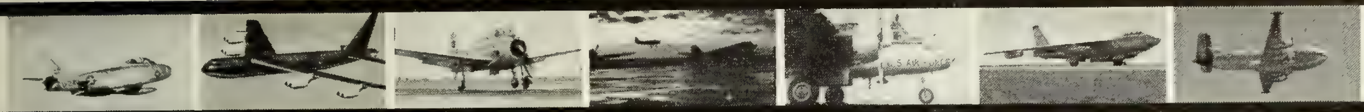
- Listen to your aircrewmen tell about a "close one."
- Read (and submit) operational hazard reports.
- If your equipment is unsatisfactory, UR it.
- Check the sick-call book with the flight surgeon. Are your pilots and airmen going on sick call more than necessary as a possible escape from flying fatigue?
- Tour your base. Are runways properly marked? Are aircraft being parked too close together? How are the overruns?
- Check the barrier. Is it in working condition?

Maybe the next weak spot will be fuel management, poor reversing techniques or will it be midair collisions?

It's always an advantage to get a head start on a problem. Instead of wondering "what's next?" a concerted effort might make it possible to say with confidence, "*This* is next." And who knows . . . the accident prevented may have been your own! ▲

Here are a few of the changes found in AFR sixty-sixteen.
This is one time you should be a "know-it-all."

the Book of thorough Knowledge



THERE'S one thing we can say about our Air Force, "We got reggalations."

There are regs on how to dress, how to work, when to sleep and what to eat. Fortunately, an Air Force gent need not know every reg in the index. The top brass folks are real understanding about this. They do, however, expect us to have a "kissin' cousin" relationship with a few regs and a "thorough knowledge" of some of the others.

Now if you don't happen to be in the iron bird business, read no farther; but if you are, this article is for you. It's on one of those regulations that falls into the "thorough knowledge" category. When you violate this reg, it's like leading with your right. You're wide open.

The regulation in question is, of course, 60-16. It's been called everything from the pilot's Good Book to a bucket of worms, but "don't fight it." It's a *must* for you.

Recently, sixty-sixteen underwent a face-lifting. She took on some extra pages and additional provisions and herein we've tried to cover a few of them. We realize that many of these new requirements are SOP for some pilots. But just remember, now they are mandatory. So let's get with it.

- Under the old reg, aircraft occupants were required to use safety belts during takeoffs and landings. Although it was good insurance against lumps, wearing the belts at all times was not required. No more. When you are in the office you must be strapped in at all times, both pilot and copilot.
- Paragraph 26 has a new twist. In addition to turning in your Form 175 and closing your flight plan, you are required to report to the weather people for debriefing whenever the weather was either unusual or not as originally forecast.
- By now everybody is pretty hep to the 1000/on top requirement. But the new reg also says that such flights conducted over a 6/10 or more cloud cover must be filed as IFR. Remember on these on/top jobs, you still must provide your own separation.
- Clearing VFR takes a little more planning now. The destination must be VFR at the time of departure or forecast to become so at least one hour before arrival and to remain VFR until one hour after arrival. Also, when filing a composite VFR-IFR flight, the point of change to IFR must be forecast to be VFR upon arrival at that point.
- The additional fuel requirement remains the same as before . . . at least 10 per cent but in no case under 20 minutes. The big change in this provision is in computing that 20 minutes. Many is the jet pilot who uses the 20,000-foot fuel consumption figure for computing his 20-minutes reserve. The requirement now is that the 10,000-foot maximum endurance chart must be used. In a T-33, for example, 20 minutes at 10,000 feet comes out to around a 106-gallon reserve requirement, while at 20,000 feet it is only 84 gallons. Also check those NOTAMS. Any known traffic delay must be considered as "time en route" when computing fuel.
- On the subject of flight planning, paragraph 44 states that pilots will complete an AF Form 21a before each flight. The exceptions are when VFR local or within 200 miles of the point of departure; if your major command prescribes the use of a more detailed form, or if you are lucky enough to have a rated observer who has prepared a Form 21a or a more detailed one.
- You will notice under paragraph 42 that a pilot with his own clearing authority may clear his formation . . . *IFR yet.* This is the first time a 2-1, for example, could clear an aircraft IFR when he was not actually at the controls. The reasoning here is: "Who is better qualified than a 2-1 to clear his own formation?" An Airdrome Officer? Hardly, for to pull AO you need but a total of 1000 hours and five years. And an AO need not necessarily be checked out in the aircraft he is clearing.

Speaking about clearing authority, it is a pilot's elective privilege. Clearance agencies will review and approve or disapprove flights when so requested by the pilot, even though he possesses his own clearing authority for that flight.

- Remember the old landing visibility requirements of "1 mile day and 2 miles night"? Forget 'em. The visibility minimums for range ADF, VOR and ILS are published in the Pilot's Handbook along with the minimum ceilings.

GCA minimums are still in the Radio Facility Charts and in no case will they be lower than 100-foot ceiling and ¼ mile visibility.

Well, there you have just a few of the changes in AFR 60-16. They should have proved informative. But more important, they should whet your appetite for more.

So, don't stop here. Pick up the P.I.F., find the new sixty-sixteen and have at it! ▲

The amount of braking action you can expect is indeed an elusive thing. This article, prepared for FLYING SAFETY, is designed to give you an insight to the braking problem. It is on the mechanisms of friction.

William M. Roberts, WADC

...the Braking point

NEXT TO a promotion the most elusive subject is coefficient of friction. Much is written about the first, promotion, without results. Let's discuss the second most fleeting subject, friction, and hope for some improvement.

The purpose of this article is to acquaint pilots with the basic mechanisms of friction and to give some impression of what figures may be expected under varying conditions.

The friction that occurs when you apply the brakes on today's aircraft produces heat with resultant destruction of one or both of the friction surfaces. Each time your aircraft is brought to a stop, a certain amount of destruction takes place.

Let's not consider the type of destruction that you read about in accident reports but the controlled type of destruction so necessary during brake application during maximum braking. What really happens when you stand on the binders to stop your aircraft? You may feel that the only limit in stopping is "how hard can I push." What then are the limiting factors? Surprisingly enough we find that the brake is completely by-passed in a discussion of this type. We must, theoretically, by-pass the brake and look at the tires, for here is the answer. The limiting factors of maximum stopping effort are:

a. μ—coefficient of friction between the aircraft and the ground. Mathematically: F/N.

b. N—normal aircraft weight available throughout the stop and supported by the braked wheels.

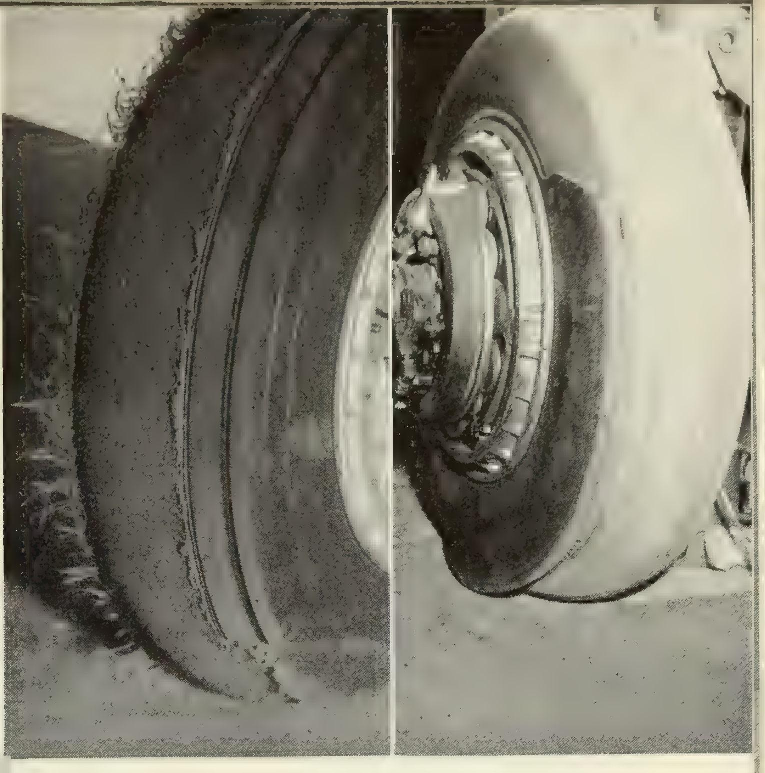
c. F—friction load when slipping impends.

Let's consider item (a) only. In order to discuss coefficient of friction we must squat on our haunches (lay on your belly if you want) and gaze at a spot on the ground. This spot is the place where the tire and ground meet and we shall call it the ground contact area. We are looking at this small area for the purpose of discussing friction. If we are to understand what happens we must first understand general considerations of basic friction mechanisms.

Basic Friction Mechanisms

Frictional forces are called into play at the common boundary of the tire and the runway when the tire is rolling or sliding. The friction is caused partly by the interlocking and shearing of the irregularities in the two surfaces and partly by direct cohesion between the molecules of the contacting surfaces. This is the basic mechanism of dry friction. If the surfaces are rough, the first cause will prevail and friction will be high, but if they are comparatively smooth, friction will be low. The shearing of a continuous film, or wet friction, is the phenomenon to be considered on wet runways. Wet friction need not necessarily be confined to wet surfaces in contact. For example, in a burning skid on a dry runway the leading edge of the contact area

The B-26, "Wingless Wonder" provided valuable data. The wings were clipped to eliminate lift.



Above, notice the condition of these tires after heavy braking.

would be under the influence of the basic mechanism of dry friction (tearing, shearing) while the trailing edge would be under the influence of wet friction due to molten rubber generated by the burning skid.

If the heat generated is not sufficient to melt the rubber, small particles torn loose by the shearing action will ball up, and acting as small rollers, will reduce the maximum friction value obtainable. On a wet surface the mechanisms of friction are reversed. The leading edge of the contact area is subject to a water film acting as a lubricant. The trailing edge by comparison is dry since the water has been wiped and squeezed out by the pressure into the grooves of the tread.

This is the briefest sort of discussion of wet and dry friction processes, but now let's go back to the ground contact area.

As mentioned previously, frictional forces are called into play at the common boundary of two surfaces (ground contact area); the tire, the runway. Let us look at these surfaces for factors which affect μ (coefficient of friction). It can be shown that μ varies with the type of runway construction, the condition of the runway itself (ice, snow or rain) the speed of the aircraft, the tread material and tread pattern of the tire, and the tire inflation pressure. We must look at each item individually for its particular effect on μ.

Runway Construction

It is obvious that for each type of runway construction whether it be concrete or asphalt, the coefficient of friction will vary. The selection of the individual aggregates used in runway construction will markedly affect μ. Asphalt compositions containing fine sharp sand in the surface will produce considerably higher friction values than a coarse broomed concrete surface. Coarse sand, crushed coral, slag or gravel add definite characteristics to the surface which affect the available friction. Certain fillers used in asphalt construction will alter the surface abrasiveness. These are Corps of Engineer considerations in runway construction, and in many cases the geographical location of the runway will account for use of aggregate common to a particular locale.

Runway Conditions

The coefficient of friction at best is elusive, but we all know that ice and snow has a low coefficient of friction because it is slippery. The condition of the runway surface ice, snow, rain, dust or sand all affect μ.

It is difficult to say exactly how and why the runway conditions vary but they do. The temperature is important in determining friction values especially near the freezing point.

A classification of expected runway coefficients is given below.

Coefficient of Friction .5 to .85

Dry concrete or asphalt runways.

Coefficient of Friction .1 to .4

Wet concrete or asphalt runways. This category is particularly susceptible to runway construction and tire design. No particular danger exists due to wetness and smeary film on coarse type runways since no continuous film can develop. However, on wet, smooth asphalt, utilizing smooth tires where no escape of displaced fluid or particles is possible, and where contact pressures are low, the coefficient may drop to below .1. There is little chance for the dry friction process to take effect.

Coefficient of Friction .25 to .35

Snow covered runways which have not been exposed to higher temperatures than about 25 to 29°F.

Coefficient of Friction .20 to .25

Snow conditions at temperatures just below freezing point. Snow covered runways at temperatures below freezing point exposed to sun.

Coefficient of Friction .075 to .2

- Slush or rain on snow or ice covered runways.
- Change from frost to temperature above freezing point.
- Change from mild to frost (not always).
- The type of ice that is formed after long periods of cold.
- A thin layer of ice formed by frozen ground having been exposed to humidity or rain at 32°F. or above.

The above classification is given only as a general guide to acquaint readers with the fact that the coefficient of friction, thus braking action, is indeed an elusive thing. There are so many variations in runway conditions that each condition must be measured separately. However, it might be well to illustrate the effect of μ in terms more readily visualized, stopping distance. For a particular aircraft and landing configuration minimum stopping distance would be 5300 feet with an average μ value of .1. Under the same aircraft conditions stopping distance would be decreased 43 per cent or to 3000 feet, with a μ value of .4. Remember that stopping distance will also depend on the per cent of aircraft weight available on the braked wheel throughout the stop (lift-drag) and is therefore not directly proportional to change in μ. "Northrop Service News" dated November, 1955, carries a complete article on stopping distance for F-89 aircraft and may be consulted for more detail on this type.

Now, back at the ground contact area, there are still other factors which affect coefficient of friction.

Tire Pressure

Low tire pressures are more conducive to penetrability and interlocking of the irregularities in the two surfaces, thus the dry friction phenomenon is better able to come into play. High tire inflation pressures reduce the dry friction effect, as well as contact area, with resultant lowering of coefficient values by as much as 30 per cent.

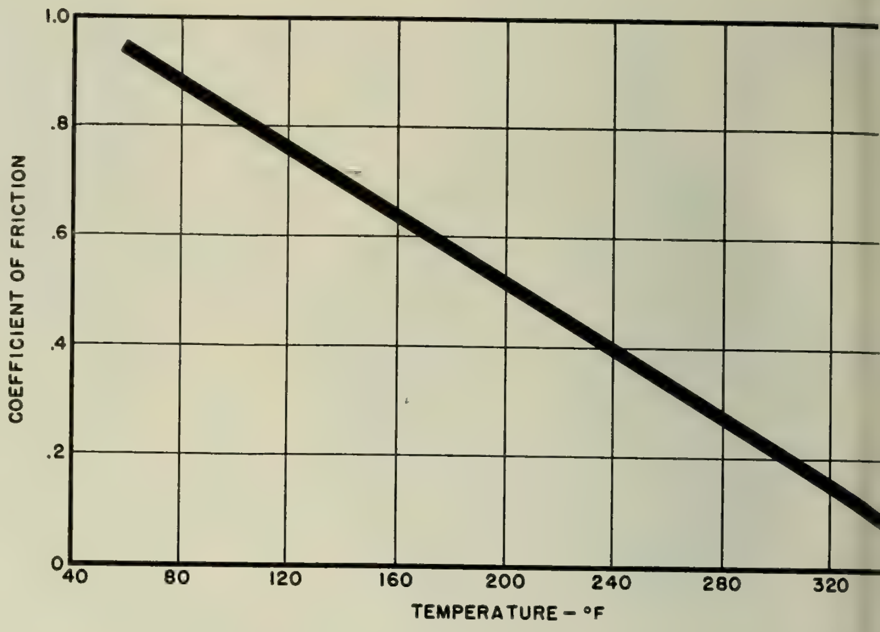


Figure 1. The coefficient of friction decreases as temperature of the tire rubber rises.

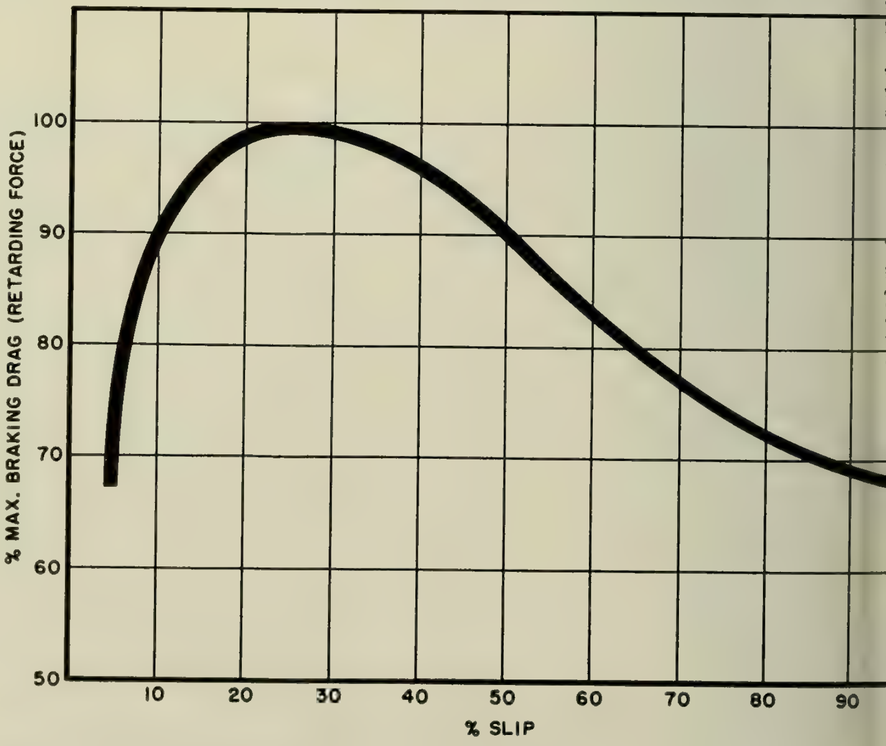


Figure 2. Note the effectiveness of braking versus tire slippage. Some slippage is needed.

Aircraft Tire Tread Design

Tread patterns are usually designed to meet the requirements of a specific application. Tread design for wet or slippery surfaces must include two basic provisions. First, provide for wiping action. The tire must act as a wiper to remove moisture in order that the predominately higher mechanism of dry friction can prevail. Second, a relief for water or loosened particles is required to aid and abet the wiping action. Tread designs of this type include countless small wipers and grooves which are unfortunately too weak and unstable for the rugged requirements of high-speed aircraft tires. Small sections tear and strip out under high contact pressure loadings associated with aircraft tires. High centrifugal effects, brake torque, spin-up loads, lateral scuffing and impact loads literally tear an unstable tread design apart. The choice of material or tread compound is important from the standpoint of physi-

With the installation of anti-skid brakes, getting tires into this condition is almost eliminated.

cal strength, hardness, elongation, resistance to cutting, cold temperature flexibility and heat conductivity, and a careful selection must be made when considering the material for application in a particular tread design. In short, aircraft tire tread design is a compromise of all factors and no one factor can be advanced at the total expense of another.

Speed

The effect of high speed on coefficient of friction is not too well known. All research papers on this subject show a general reduction in available coefficient with increase in speed, although at some points the coefficient appears to recover, then fall off. For the purposes here, it is not important and the significant fact is that μ at low speeds, near static, is appreciably larger than at high speeds. Temperature build-up in the tread due to high speed cannot be ignored and the effect of temperature on μ is as shown in Figure 1.

All of the original considerations given above have been discussed but yet there is still another. The last and final consideration to be discussed which affects μ is the phenomenon known as slip.

Slip

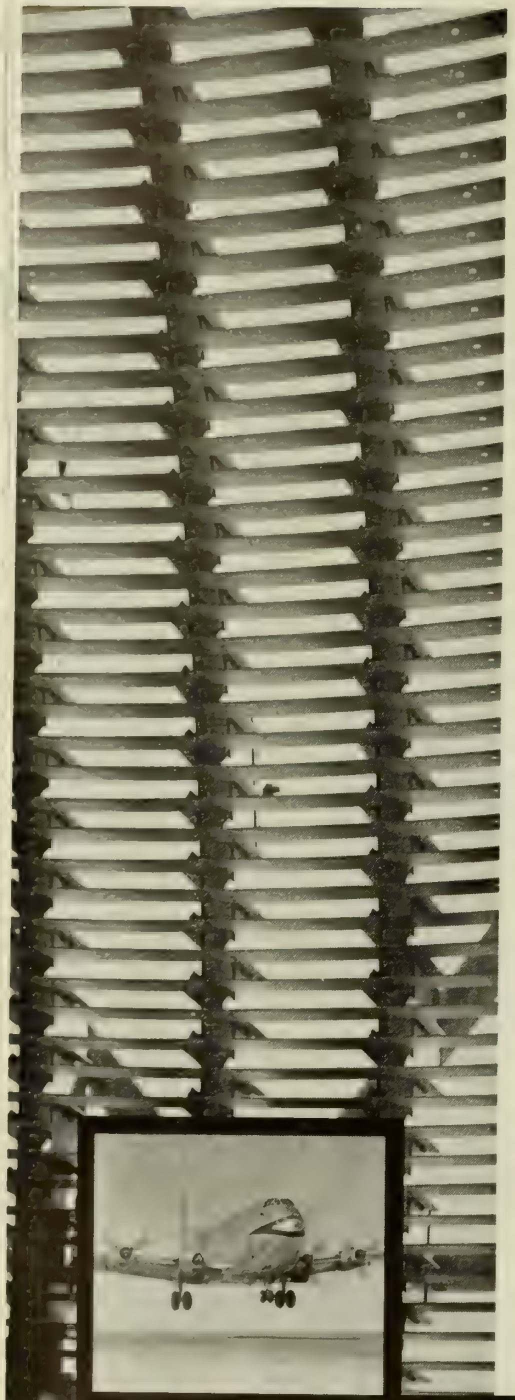
Slip is defined as the peripheral speed of a braked wheel divided by the peripheral speed of the free rolling wheel and is expressed as percentage. A non-braked wheel will have 0 per cent slip, whereas a fully skidding (locked) wheel will have 100 per cent slip. When slippage has been brought to about 20 to 25 per cent, the braking force—or F force is the maximum obtainable, and higher rates of slip does not increase, but rather reduces this retarding force. This is best shown in Figure 2. The phenomenon of slip is one of the salient features responsible for the development of anti-skid devices. A brief analysis of this figure clearly outlines two basic requirements for any anti-skid system.

1. Eliminate 100 per cent slip, sliding friction, locked wheel.
2. A system to operate satisfactorily under all conditions as close to the peak of the curve as possible.

Remember that anti-skid does not make, alter or reduce μ; it only utilizes effectively what is available.

Current Air Force aircraft equipped with anti-skid devices are capable of finding and utilizing old elusive μ. They are the B-47, B-52, B-66, KC-97 (MATS), SC-54, F-100, C-123 and the C-133 types.

And now that you have been sufficiently imbued with firm, well-fixed figures and ideas on the subject of braking action, the next time you are backed into a corner with specific questions, you can (intelligently) comment, "Well, it all depends!" ▲



the GCA angle

THAT'S GCA; it's an approach system and not a blind landing system. The equipment was designed to get you to the established minimum and continuing below this minimum should be accomplished only under emergency conditions.

Of course, you've flown some actual IFR precision GCA runs that you really grooved. In these "sno sweat" runs you had the feeling you could have flown right onto the concrete slab, and then there have been other runs. . . . Remember?

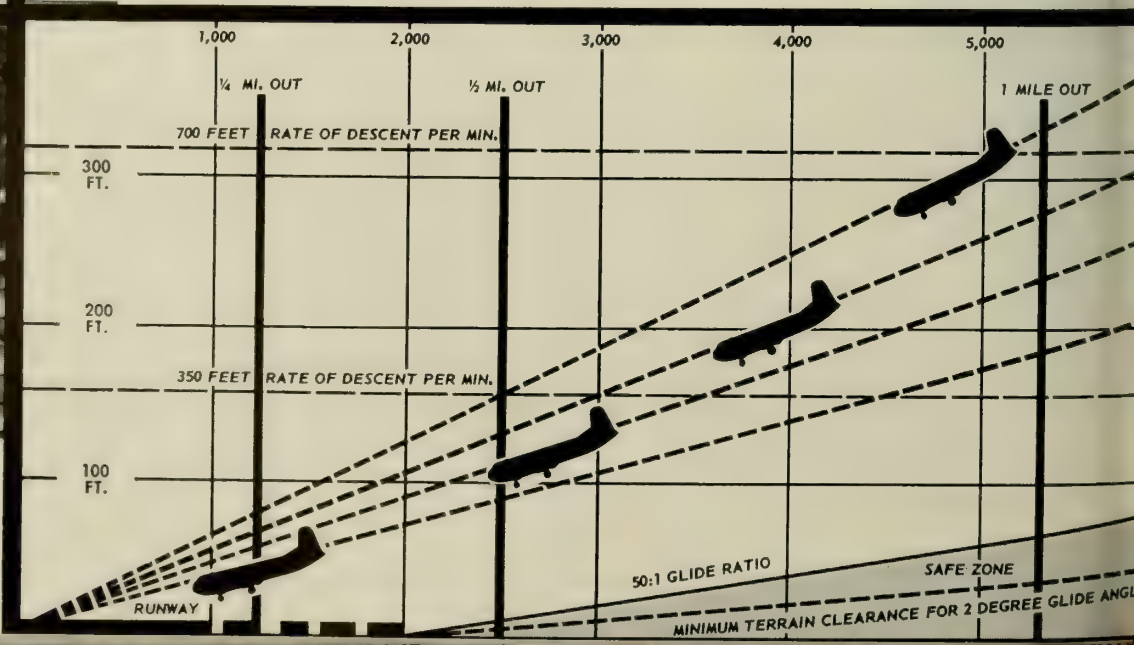
Even under the best conditions, radar is not yet a perfect system but it serves satisfactorily for making safe low approaches and we couldn't very well do without it at this stage of the game. It is not intended to put you on the runway in zero-zero weather. It has earned its keep when it places you in a position from which you can land your aircraft visually.

The GCA final controller will continue to give instructions until the aircraft reaches the touchdown point. However, as pilot, you fly the gages down until the runway is visible, then you make a visual approach and terrain clearance is your responsibility. When the established minimums are reached and the runway is not visible, that's the time to call off the dogs (there'll be other parties anyway), and make for your alternate. You've just had the best offered by a radar approach system.

Okay, you may say, "If I poke my nose down just a little more, that runway may pop out at me." Look out, son, you may never make another party. Here's why.

A precision approach radar glide path has an optimum setting of 2½ to 2¾ degrees. The minimum is two degrees and normally the maximum is three. Now to obtain the minimum clearance for the final approach, an average glide path (2½) intersects the runway 750 feet from the approach end of the runway. This point of interception is referred to as the GCA touchdown point. This particular glide path clears the threshhold by some 33 feet, and at the 500-foot

The wheels hang somewhere below the glide path. They will hit short of the GCA touchdown.


1,000
2,000
3,000
4,000
5,000
¼ MI. OUT
½ MI. OUT
1 MILE OUT
700 FEET RATE OF DESCENT PER MIN.
300 FT.
200 FT.
350 FEET RATE OF DESCENT PER MIN.
100 FT.
50:1 GLIDE RATIO
SAFE ZONE
RUNWAY
MINIMUM TERRAIN CLEARANCE FOR 2 DEGREE GLIDE ANGL

There are a lot of reasons why GCA should not be considered a blind landing system. This article presents one that you may not have known about. The same applies for ILS runs.

Captain Ross A. Beckham

Investigation and Safety Engineering Div. D/FSR

mark it is 12 feet above the runway. Now that doesn't sound particularly alarming, but here is the pitch:

What clears the threshold by 33 feet? The landing gear? The nose of the aircraft? The tip of the vertical fin? This we gotta know before we go poking our nose down any more after passing through GCA minimums.

The radar blip that the controller sees on his scope is a reflection from your bird. The radar responds best to sheer mass and external activity.

So, let's take a big aircraft, say a C-124, on a GCA precision approach. You're on glide path, on centerline. You break out, runway's in sight and you round out and land. Did you notice how high you were over the threshold? Probably not, but remember, on a 2½ degrees glide path and a 750-foot touchdown point, the center of the radar blip passed just about 33 feet above the runway threshold. Of course that is assuming the operator had a good target, the equipment was working right and was properly aligned, the controller was skilled and you were flying exactly as instructed.

Okay, the controller tries to keep the middle of the target in the centerline and on glide path. With most of the return coming from a point where the wings intercept the fuselage, where does that put your wheels? About 15 feet above the green lights.

Now if you are flying a 2 degrees glide path with a 500-foot intercept, things are even worse. And, try this on for size—you never know what glide path angle a particular unit uses.

But let's get back to a *nice, safe* 2½ degrees glide path and a 750-foot GCA touchdown point. In the above discussion you will note that your wheels clear the threshold by 15 feet. *This is the figure, only if you and the controller are doing your jobs perfectly, and the equipment is functioning properly.*

Let's goof things up a bit. Depending upon the individual controller (particularly how he uses his gain control), your target may vary from the size of a pinhead to that of a skinny peanut. A good average would be the size of a grain of rice appearing vertically on the scope. The controller has to watch two pictures, one above the other on one scope. One is for azimuth, the other for elevation. You, in your 70-ton mass of hurtling machinery, will appear as a spot of light and you won't hold still. You just keep rolling along. He has to give oral directions to you as best he can to keep these little spots centered on the centerline and glide path.

When he says you are 10 feet low on the glide path, that's his honest conviction. But he can't be positive because the equipment does not provide the capability. That's what his interpretation of the scope tells him and he's doing the best he can with what he's got.

How About You

Next, let's talk about you, the pilot. We've already told you that neither the radar equipment nor the controller is perfect. Let's face it, you're not either.

The smoothness and finesse with which you handle your airplane can make a big difference. Remember, that boy on the ground is a sort of electronic-age parking lot attendant. He can tell you where to put your bird, but it's up to you to put it there.

Don't let yourself get so engrossed in his directions that you disregard his remarks upon reaching minimums. Or that you forget to fly your own aircraft. Don't be timid about using power in glide path corrections, if necessary. If you slip a little low you can usually ease it back with a little back pressure, but there's a limit to this easing back on the wheel. Without warning you could find yourself nose-high and hunting for airspeed on the backside of that infamous power curve.

I think by now that 33-foot threshold clearance has shrunk considerably. Between dangling wheels, equipment limitations and the controller/pilot inherent incapabilities, taking her down to the concrete just isn't the thing to do.

Incidentally, this also applies to an ILS approach, depending upon where the glide slope receiver antenna is positioned on the aircraft. If it is located on top of the vertical stabilizer, your wheels will be a fair distance below the glide slope.

ILS or GCA are fine approach systems but, are only intended to get you to a certain point on the approach to the runway. From there on, you have to land VISUALLY.

So when the man says "passing through GCA minimums," take over and complete your landing visually or give 'er the needle . . . make for the wagon . . . and here's hopin' you've picked New Orleans as your alternate. ▲

REX SAYS

THERE ARE a number of Air Force bases that rely either wholly or in part upon Military Flight Service for weather forecaster service. Many times, however, these bases do have an Airdrome Officer on duty for clearing purposes.

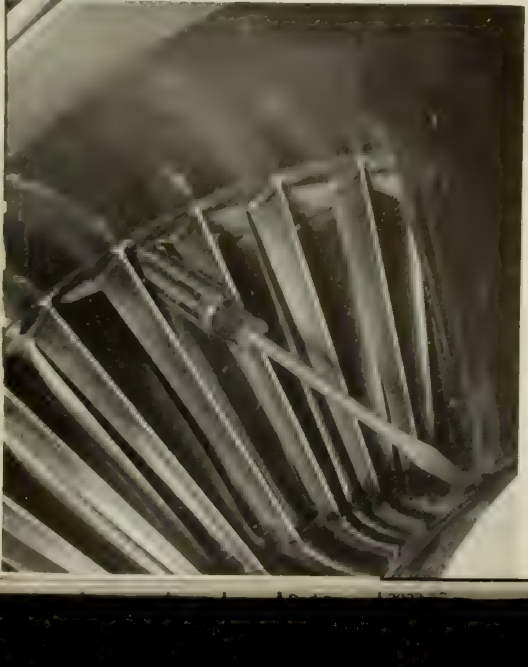
Normally the pilot calls the forecaster, receives the weather briefing and copies certain conditions for his destination and alternate. He then hands his clearance to the AO, who looks it over and clears the flight. The hair in the butter is that perhaps the forecaster relayed a hazardous en route condition that the pilot failed to enter on the Form 175.

REX SAYS*—If you're an AO at such a base, get in on the weather briefing. If you are the pilot, be sure to let the AO in on any hazardous conditions given by the forecaster. The AO can be of assistance to you only if he gets the whole picture. He is there to help you so why not use him?*

★ ★ ★

MORE ABOUT preflight inspections. Take a look at the picture here, showing a screwdriver which became lodged where it is only because it was too long to go into the engine of this F-84F.

Members of the Flight Safety Deficiency Task Group (at Mobile AMA) sent us this photograph and have requested FLYING SAFETY to print another reminder, urging better preflight inspection.



REX SAYS*—Much has been printed about preflight inspections, and foreign object damage to aircraft. I shudder to think what would have happened had the drive end of this screwdriver entered the engine.*

★ ★ ★

BACK in July FLYING SAFETY published a letter which argued that "There's no such thing as VFR night," and that such clearances should not be authorized. I would like to add my voice to this cry with the following tale:

One night in August we were on the return leg of a scheduled C-47 passenger run. The weather had been forecast as scattered, with visibility of 15 plus but, as per the SOP for this scheduled flight, we filed IFR.

About 45 minutes out, we hit a belt of thunderstorms and were pretty well beaten up by the time we got through. Contact was made with Radar Approach Control and we were in and out of moderate turbulence and rain as they vectored us during our descent. We broke out below the stuff in moderate to heavy rain at 3000 feet and entered a long dog-leg to final. All of a sudden, red lights went flashing by from right to left and from the speed, they *had* to belong to jets.

We screamed at Radar for not telling us about the other traffic and they told us they had nothing on the scope. Most likely, all the heavy rain storms in the area had them blotted out. We hit the GCA final. Three miles out, GCA said the tower cleared us all the way. The rain was now light to moderate, and with the windshield wipers going full blast we could see the runway easily. At about a mile and a half, more red lights were spotted by the other pilot, at our altitude and 180 degrees to our direction. Before he could say anything more about them they turned 90 degrees toward us and the first indication I had of another aircraft (I was making the GCA) was its landing lights shining in my face. At this instant, the other pilot grabbed the controls and broke.

Yep, you guessed it. The jets that passed us before were VFR (in the rain), and the tower was landing another aircraft VFR on Runway Left while we were making a GCA under what we thought was instrument conditions to the parallel runway.

The tower failed to inform GCA and us that they had other traffic in the pattern. The GCA operator later swore that he could not see the other aircraft on his scope. It never occurred to us that there might be VFR traffic churning around in the rain. Flight level visibility appeared to be less than three miles (although we were able to make out runway lights from three miles), and there had been scud clouds at 2000 feet before we intercepted the glide path.

Forward flight visibility was certainly less than five miles outside the control zone.

The weather station was reporting 3000 and 7, but therein lies a fallacy. Their reading was taken at station location and they had no idea what was happening in the rain squalls away from the field. Also, their reading was taken without benefit of rain-on-the-windshield and wipers that, at best, made visible objects a misty blur. Results:

- Fast moving aircraft were buzzing around a busy airport, in and out of rainstorms that they couldn't possibly pick out in the darkness, no matter who said they were VFR.

- Aircraft were making instrument letdowns and pilots must have thought they had a whole section of the sky to themselves.
- A weatherman was inviting disaster because he could stand in a sheltered area and see 7 miles through the rain.
- A control tower operator believed that because the weatherman said it was VFR, everyone else in the area knew it too. So he didn't advise GCA of other traffic.
- A crew that was pretty well shook when it got on the ground.

The passengers were already disgusted with this flying business by the time they got through the thunderstorms. The sudden break-off and application of power on the final was probably the touch that will send most of them to the train station the next time they want to go anywhere. In fact, if we (the crew) get shook any more than we did on this approach, we just might join 'em.

It all boils down to this. Keep the odds in the pilot's favor. File everybody IFR when the conditions warrant — especially marginal nights — instead of blandly holding up AFR 60-16 and quoting "when the visibility is greater than 3 miles and the ceiling . . ."

REX SAYS*—Got to go along with you. When the weather is marginal ALWAYS file IFR. Of course in this case the boys were clearing to this base on the forecast of scattered and fifteen. But by George, there is nothing wrong with changing to IFR when it becomes obvious that the weather has deteriorated to such.*

★ ★ ★

THEY just don't realize how much the injury potential increases whenever a crewmember or passenger unfastens his safety belt or leaves his seat. Take an incident that happened in our outfit the other day. On a round-robin IFR flight the aircraft commander of a C-119 went to the rear of the plane. While he was back there, the aircraft encountered turbulence causing him to fall to the floor and fracture his right knee and sprain his left ankle. Fortunately, the copilot was well qualified and he flew the remainder of the mission without further incident. The crew stated that there was no horseplay with the controls at the time of injury, and that the fall was caused by actual turbulence or by the copilot's making altitude corrections or both.

The point I want to stress is the ease with which even a man of exceptional reflexes can be upset in flight if he is not anchored to the aircraft, either by a safety belt or by grasping some part of the aircraft.

I suspect that most of us have been aboard an aircraft in which a pilot jokingly used uncoordinated control pressures to annoy another crewmember. I know of a pilot in another organization who was hospitalized for several weeks with a badly broken leg which resulted from horseplay with the flight controls while he was in the rear of the plane. What started as a well-intended prank, ended with the aircraft commander's requiring painful surgery. In addition, the aircraft and crew were subjected to unnecessary hazard while the inexperienced copilot made his first letdown under actual weather conditions.

Loss of balance is also very common during taxiing. Some passengers seem to feel a sense of accomplishment if they can sneak through a landing with an unfastened safety belt or if they can wander about the plane gathering belongings while the pilot is taxiing to the ramp. They hurry to save one minute and then wait five, while the crew chief opens the exit. But strangely enough, rated

REX SPECIALS

THE PILOT of an F-100A recently experienced an inflight emergency, the complete details of which would have been both interesting and highly instructive to every F-100A fighter pilot in the Air Force.

While flying at 27,000 feet the pilot noticed a drop in oil pressure. He reduced power and approximately one minute later the engine started to vibrate. The RPM dropped to 80 per cent, a loud banging noise was heard by the pilot and the oil pressure dropped to zero PSI. The engine was stop-cocked and the pilot then heard a loud grinding noise. Gradually the tachometer went to zero RPM indicating that the engine was frozen. The pilot was close to his home base and he successfully completed a dead-stick landing with only the ram air turbine pump supplying flight control system hydraulic pressure. Information on this emergency was obtained through the manufacturer's publication and consequently omitted the details of the techniques used by the pilot, handling characteristics of the aircraft, flight control pressures used or hydraulic pressures noted. These are items in which every F-100 pilot would be vitally interested.

REX SAYS*—Air Force Regulations do not presently require submission of incident reports on occurrences of this nature. It is contemplated, however, that 62-14 will soon be revised to require submission of incident reports on all forced landings and to encourage submission of reports on other unusual occurrences or near-accidents. In the meantime, all organizations are urged to forward incident reports or reports of unusual occurrences which might be of value to pilots of similar type aircraft. Help your buddy—by passing on what you have learned.*

"I really don't believe this qualifies you as an all-weather pilot, Gridley."

personnel are among the worst offenders. Sudden use of the brakes may at any time cause serious injury to a man who is not secured in his seat.

The aircraft commander must insist that passengers keep their safety belts fastened through all phases of ground operation while engines are running. Occasionally such firmness will make him unpopular with the inexperienced or immature passenger, but this procedure will surely pay off in fewer injuries.

REX SAYS*—You're right. I've seen reports on these things before. They're funny — like a rubber crutch! ACs neither run popularity contests nor allow their copilots to regress to the short pants department. Horseplay is for the horses.*

★ ★ ★

AFTER NORMAL preflight (taking for granted the crew chief would remove the gear pins and pitot cover) I taxied out for takeoff in an F-100. I noticed on the takeoff run that my airspeed was reading low, but with at least one-half of the runway gone I decided that to continue takeoff would be the safest procedure. After becoming airborne, I called another F-100 and he brought me back and assisted in the landing.

REX SAYS — *Anything said here would be old hat. What is most interesting about this incident is that such things are still happening. Don't become complacent. Always, and I mean ALWAYS, check visually to see that the pins and covers are removed prior to taxiing.*

★ ★ ★

ANY PILOT who doesn't know how to tune in an ADF set properly these days should be lashed smartly with a wet pitot tube cover. What follows actually happened in my squadron.

Three of my buddies were cruising along in formation with the leader of the flight doing the navigating. Weather at destination was VFR below an overcast. Penetration fix was a homing beacon.

About 10 minutes out, the leader cranked in the published kilocycle frequency of the beacon. He flipped the selector knob to COMP position without listening to the station identification signal. The needle swung over to 300 degrees and froze there. And that was that!

Only it wasn't that. A strong adcock range station some distance away whose frequency differed by only six kilocycles from that of the homer, attracted the ADF needle.

Rest of the story. The flight penetrated and broke out VFR with a menacing range of mountains just off to their left. Shook? You bet. They flew pilotage the rest of the way in.

What in the deuce were the other two pilots doing? Just riding. Not flying. If they had been, they would have been double-checking all along.

It is not unusual at all to find radio compass sets that are from five to six kilocycles off frequency.

REX SAYS — *Now "ear" this. It's basic and real important to get positive identification regardless of the type of radio equipment you have.*

★ ★ ★

THE ELEVATOR trim tab coupling on a C-119G was changed during a periodic inspection. Upon completion, the elevator trim was run through several times and checked okay. It was inspected by the pilot before the test hop and was run through full up and full down limits. Seemed all right. On takeoff the aircraft climbed sharply and both pilots had to get on the controls to keep the nose down. They were able to land, however, without damage to the aircraft. Inspection revealed failure of a bearing in the system caused the erratic operation of the trim mechanism.

The pilot stated that the knowledge gained from reading the "Well Done" article in FLYING SAFETY for March 1956 aided him in controlling the aircraft. He said that had he not left the gear lowered, he doubts if it could have been controlled.

REX SAYS*—These gents did a nice bit of work in getting this big bird down in one piece. What with Playboy and Esquire on the PX newsstands it is sometimes a chore to work FLYING SAFETY reading in. But I figure I'm safe in saying I'll bet this fella's glad that he took the time to read that "Well Done" feature.*

Something for Uncle

This month marks the end of the year 1956. You of the Air Force have presented Uncle with the best Christmas present of all—a reduced aircraft accident rate. This year was one of real advancement in the field of military aviation. The century fighters swung into full action, jet bombers finally replaced the World War II birds and turbo-props entered the aircraft scene.

★ ★ ★

In this day, conservation of personnel and materiel, through the prevention of aircraft accidents, presents a new challenge. Aircrews must be just a little sharper, supervision takes on a new impetus and maintenance procedures must be keyed to meet the new designs. You of the Air Force possess the finest fighting equipment in the world. Let's start our Christmas shopping early and next year present Uncle with an even better present for 1957—"The lowest accident rate yet."

★ ★ ★

During the coming year FLYING SAFETY will concentrate on known problem areas in the field of accident prevention. Past experience will serve as our guide. The majority of accidents are caused by:

- Pilot Error..................49 per cent
- Materiel Failure...........23 per cent
- Supervisory Error........ 6 per cent
- Maintenance Error....... 5 per cent

For the first 6 months of '57 we will hit supervision, the new pilot, new aircraft, flight planning, emergency procedures and aircraft crew station.

Mal Function

Though ceiling's low, there is no sweat,
For GCA is this boy's bet.
Down the glide path, don't you know,
Right on center—ten feet low.
GLIDE PATH
Right through the minimums he does fly,
And so the farm our boy will buy.
GLIDE PATH
The accident cause is not folk lore,
For details, read page twenty-four.
You can get the book for a year, you know.
Just fill out coupon—it's below.
US MAIL
COUPON

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Please send Flying Safety Magazine for one year to the following address. Enclosed is a check or Money Order for $2.50. ($3.50 for foreign mailing.)

Name______________________________

Address____________________________

City____________________ State__________

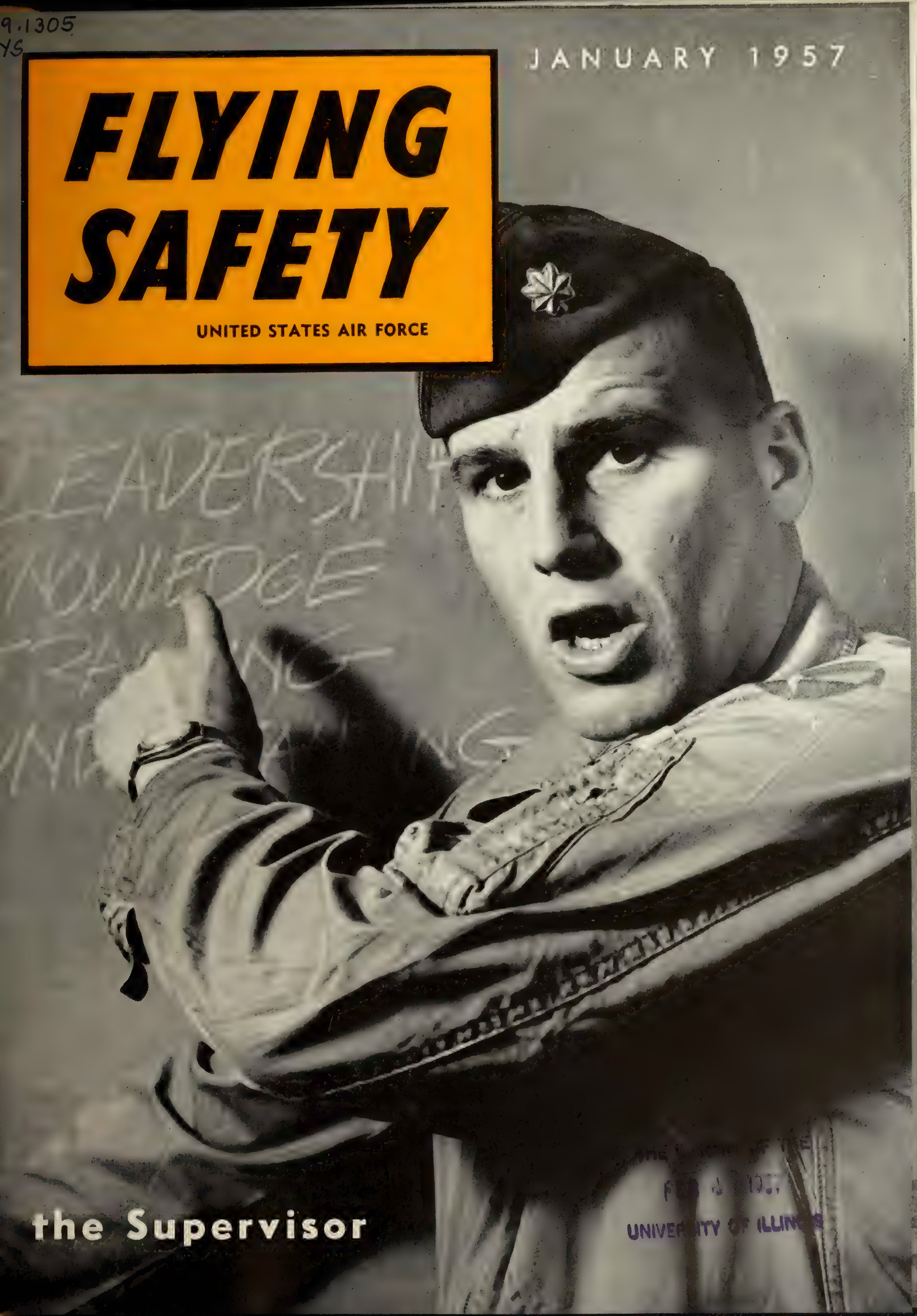
*U. S. GOVERNMENT PRINTING OFFICE . . . 402037

9.1305
YS

JANUARY 1957

FLYING SAFETY

UNITED STATES AIR FORCE



the Supervisor

THE LIBRARY OF THE
FEB 1957
UNIVERSITY OF ILLINOIS

File Thirteen

This month our cover symbolizes the "supervisor." This happens to be our special subject for this month, in keeping with our yearly program. You can get the whole pitch by reading page one.

In October, "File 13" made reference to the inadequate crash rescue facilities at some P and PC fields. I guess we should have gone on to point out some of the other deficiencies one might expect at this type of installation. P and PC fields are not set up for the military. They have a landing privilege agreement . . . PERIOD. Okay, so they have your type of fuel on contract. This doesn't mean they know how to get it into your particular type of aircraft. Likewise, for oxygen and oil servicing. Further, do not expect them to provide wingwalkers, to comply with Air Force spacing standards or to insert canopy or seat pins. Even if there is somebody on hand to provide some of these services, you had better supervise the whole operation. Just remember, that individual crawling all over and in and out of your aircraft may not know the seat ejection trigger from the pitot tube. Of course, if you are not completely familiar with the care and feeding of your bird, stay away from P and PC fields. And therein lies a good point for commanders and supervisors, such as Ops Officers and AOs. *Think twice before clearing some of your troops into these installations.*

Perry J. Dahl

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Please send Flying Safety Magazine for one year to the following address. Enclosed is a check or Money Order for $2.50. ($3.50 for foreign mailing.)

Name ____________

Address ____________

City ____________ State ____________

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major Vernon R. Stutts

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby
T/Sgt. Chester McCubbin
T/Sgt. Carl E. Fallman
S/Sgt. Al Fortune
A/1C Al Fagerwick
T/Sgt. G. J. Deen
Amelia S. Askew

CONTENTS

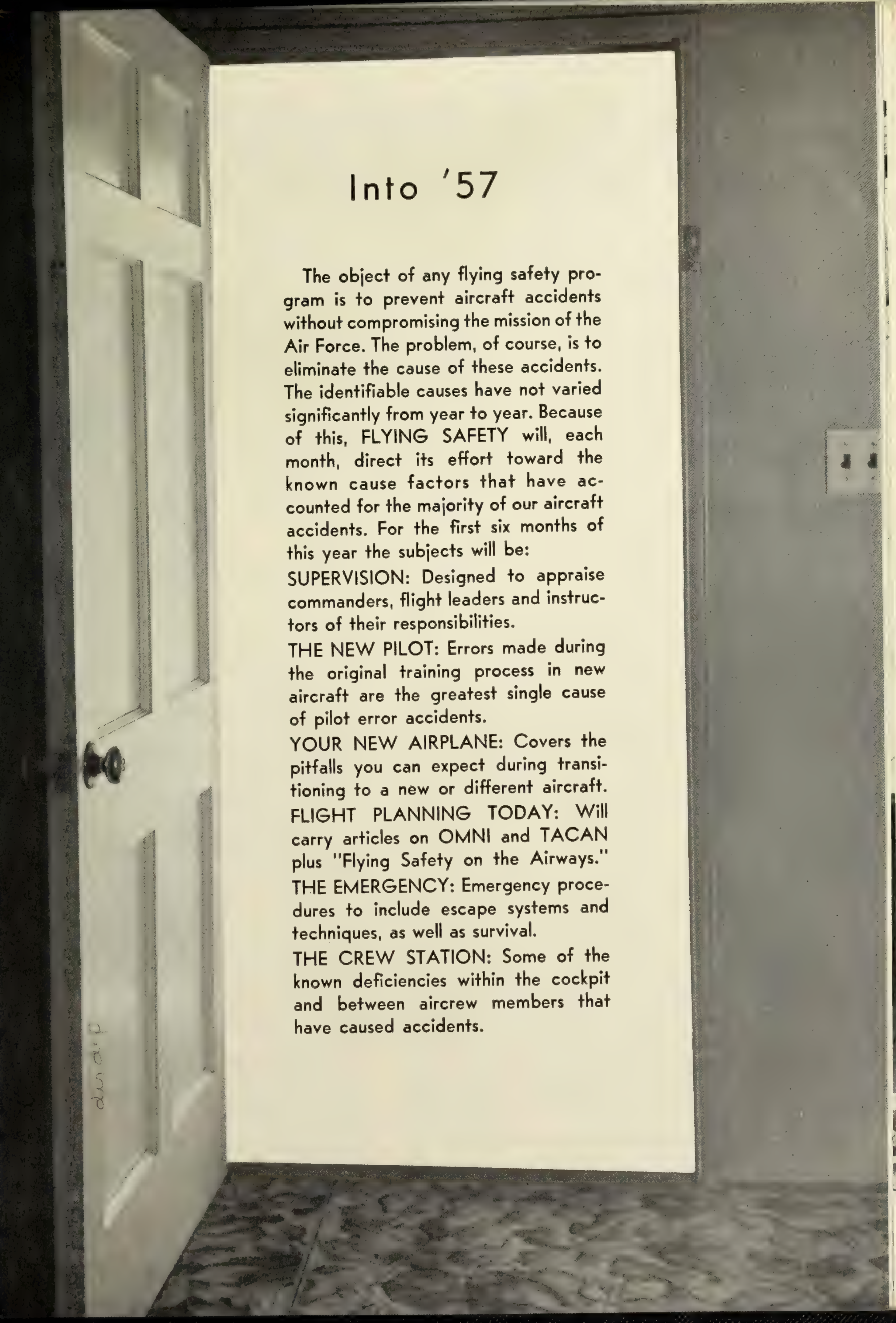
Supervisory Scoreboard 2
Take Care of Your Chicks 4
A Flight Leader Speaks 6
I Am the Master Of 11
An A/C Sounds Off 12
Keep Kurrent 17
Streamlined Sequence 18
Stop of the Century 20
Rex Says 24
The Point After Touchdown 26

VOLUME THIRTEEN NUMBER ONE

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1



Into '57

The object of any flying safety program is to prevent aircraft accidents without compromising the mission of the Air Force. The problem, of course, is to eliminate the cause of these accidents. The identifiable causes have not varied significantly from year to year. Because of this, FLYING SAFETY will, each month, direct its effort toward the known cause factors that have accounted for the majority of our aircraft accidents. For the first six months of this year the subjects will be:

SUPERVISION: Designed to appraise commanders, flight leaders and instructors of their responsibilities.

THE NEW PILOT: Errors made during the original training process in new aircraft are the greatest single cause of pilot error accidents.

YOUR NEW AIRPLANE: Covers the pitfalls you can expect during transitioning to a new or different aircraft.

FLIGHT PLANNING TODAY: Will carry articles on OMNI and TACAN plus "Flying Safety on the Airways."

THE EMERGENCY: Emergency procedures to include escape systems and techniques, as well as survival.

THE CREW STATION: Some of the known deficiencies within the cockpit and between aircrew members that have caused accidents.

dup. p

SUPERVISORY SCOREBOARD

THEY SAY big trees from little acorns grow—but that rarely impresses anybody. You walk through a forest and rarely see the acorns. Few people even see the scrub oak and the saplings. The usual thing is that the oak sits there and grows for a hundred years or so before some nature-loving soul says, "What a wonderful old tree that is, and look how big it has grown."

And this is true. Great things grow from small. And if their growth is slow, more often than not, it is unnoticed. But here is one that has grown: Accidents caused by supervisory error. And its growth has not been so slow as it has furtive. All of a sudden it was there. The facts may surprise you.

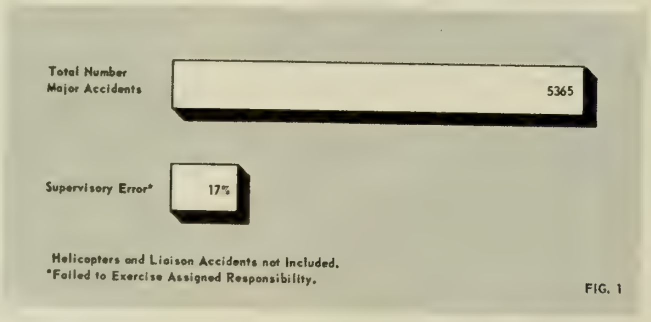
An analysis was made in an attempt to discover just what type of accident occurs because supervisors fail to exercise their assigned responsibility. What conditions result and what types and patterns of unsafe acts occur because of errors made by the supervisor of the pilot?

A total of 5365 major aircraft accidents were considered in the study. Of this number, it was found that 925 (17 per cent) involved a supervisor who had neglected to exercise his assigned responsibility.

These supervisors ranged throughout the units within the USAF organizational structure. Failure to assume responsibility resulted in numerous unsafe acts, omission of acts and inadequate decisions both from ground and inflight supervisory personnel. Sometimes instructor pilots allowed the pilot to perform a maneuver for which he was not qualified; maintenance personnel cleared aircraft without proper maintenance; operations failed to provide adequate briefing; major commands failed to provide adequate directives or regulations and so it goes—on and on.

The collision and wheels-up type of accidents were more frequently associated with unsafe acts and conditions resulting from a supervisory

Per cent of Supervisory error in total accidents studied.



Helicopters and Liaison Accidents not Included.
*Failed to Exercise Assigned Responsibility.

FIG. 1

Per cent Supervisory errors in accidents by type aircraft.

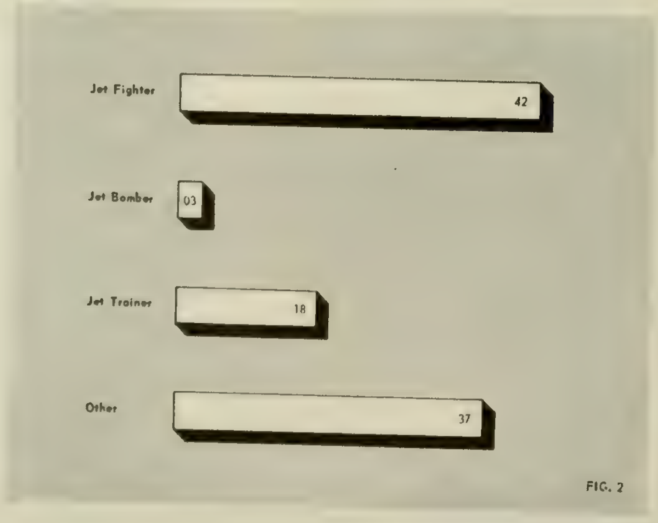
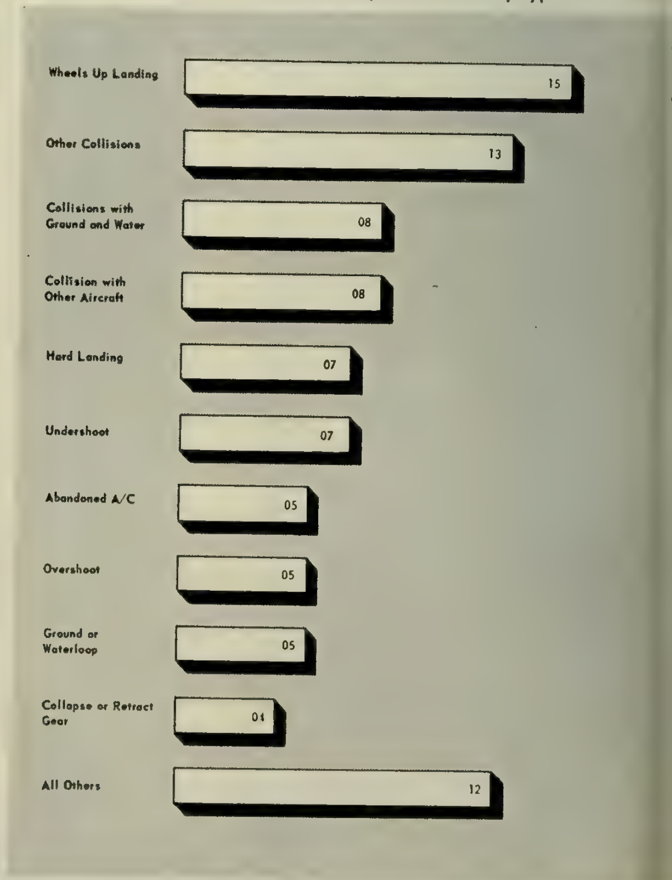


FIG. 2

Supervisory errors in major accidents by type of accident



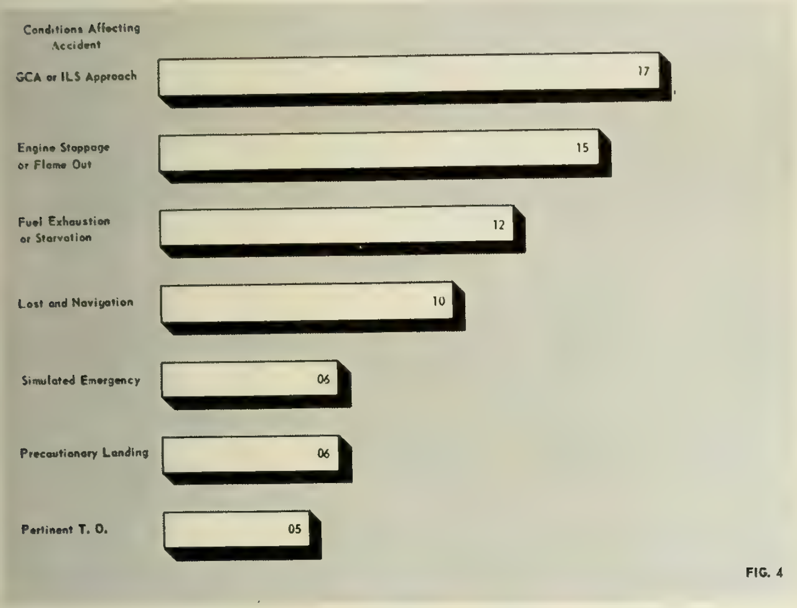


FIG. 4

These conditions occurred in more than 5 per cent of accidents studied.

Level of personnel contributing to accidents supervising from ground.

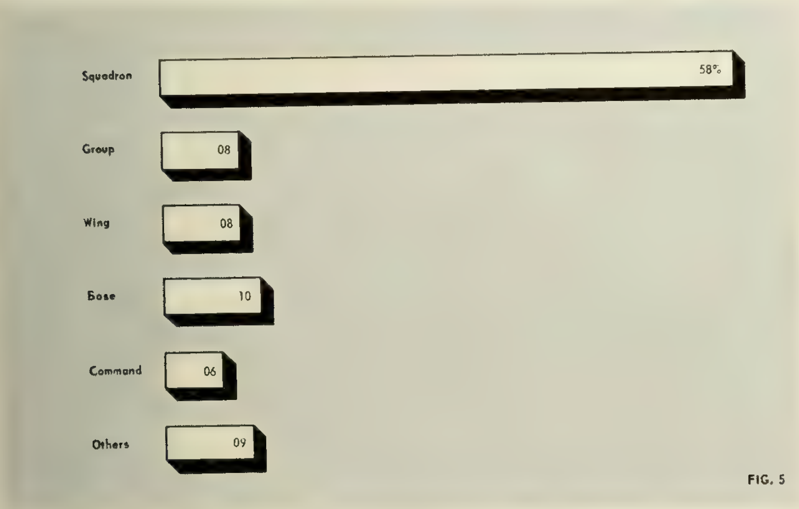


FIG. 5

Unsafe acts involved in over 10 per cent of total supervisory accidents.

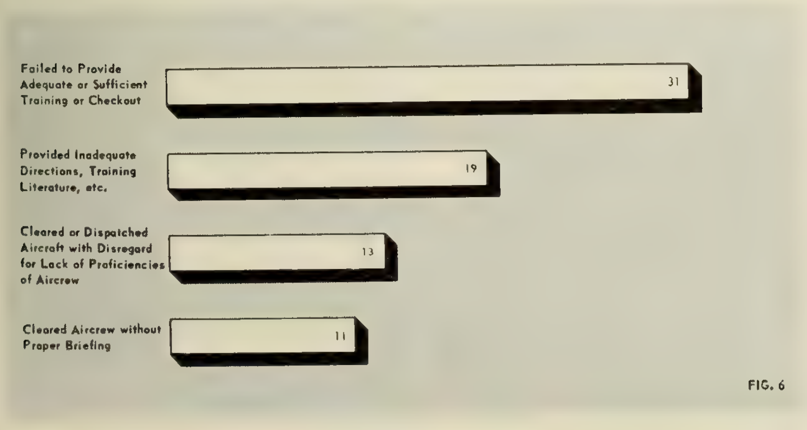


FIG. 6

error. When the 925 accidents were broken down by type of accident (Figure 3), collisions accounted for 29 per cent. Wheels-up landings accounted for 15 per cent of the total number. Again, a supervisor failed to exercise his assigned responsibility.

In over one-half of the accidents where supervisors committed an error, no prior conditions affected the accident (Figure 4). The most frequent "conditions - affecting" were GCA or ILS approaches, flameouts, fuel exhaustion and/or starvation, and navigation conditions. In 435 accidents, one of these prior conditions affected the result.

One of the most interesting parts of the whole study concerned recommendations made as a result of these accidents. You will recall that a total of 5365 accidents were studies in this survey. Only 925 reports indicated that an error in supervision had affected the accident. But—5016 reports (93 per cent of all accidents included in the study) contained recommendations to one or more supervisors for the prevention of similar accidents. These recommendations to supervisors concerned pilot training and procedures—addressed to commanders; traffic control — to operations officers; weather forecasting—to weather personnel; inspection and maintenance procedures — to maintenance supervisors, and there were even more.

The meaning is clear. Future accidents, similar to the 5016 that we've already had, can be avoided—if you recognize and squash that little acorn.

Here are a few to look for:

- Incomplete preflight briefings.
- Lack of consideration for individual capability.
- Improper evaluation of conditions and/or capability of individuals.
- Lack of specific, clear instruction or directions.
- Failure to assure understanding of instructions and/or directions.
- Failure to notify people concerned of changed conditions.
- Inadequate or improper inspection.
- Allowing an unsatisfactory, but correctible situation to exist.
- Failure to provide adequate directives and regulations.
- Release of improperly maintained aircraft for flight.
- Failure to provide the proper training. ▲

Take Care of You

SUPERVISE — it's an old Latin word, the past participle of *supervidere*, to oversee, from *super* (over) and *videre* (to see). This is as clear as crystal and yet every once in a while someone improperly declines it into *oversight*. We lose an airplane then. It shouldn't happen but it does.

Here are some oversights charged to supervisory error in 1956, an inventory of aircraft damaged or lost through the carelessness of men who were responsible for other men. Here is what happens when supervision fails:

LOST, a B-57B because the transition training of the pilot had not adequately prepared him for the flight conditions he encountered. The pilot was killed.

DAMAGED, a B-57C because revisions concerning the use of wheel brakes were not inserted in the appropriate T. O. and P.I.F.s.

DAMAGED, an F-86F because during a practice toss-bombing mission the flight leader failed to establish sufficient space to provide adequate safety during over-the-shoulder type deliveries.

LOST, two F-94Bs because the flight leader committed his flight to a penetration and letdown which left the pilots with insufficient fuel to reach an alternate.

LOST, a T-33A because after observing that the right wing tank was not feeding, the instructor pilot failed to take corrective action and because later, when the airplane snapped into a right spin, he waited too long to initiate recovery.

LOST, two T-33As because the instructor pilot in one airplane gave his student acrobatic instruction in the transition area occupied by other aircraft, and because student pilots in transition had not been briefed on a new climbout procedure which might even then have prevented the mid-air collision that took place. One pilot was killed.

DAMAGED, a T-28A because a student pilot was cleared to fly this aircraft in which he was not proficient.

DAMAGED, a T-28A because an improperly installed fuel pump was not discovered until it had caused a serious fire.

DAMAGED, a T-28A because a runway control officer failed to recognize a hazardous condition on a runway used by student pilots.

DAMAGED, a T-28A because the instructor pilot failed to notice that his student had descended below a safe minimum altitude.

LOST, a T-28A because while flying in trail formation an instructor pilot flew in a reckless manner, leading his student through an unauthorized maneuver and causing the student pilot to stall his airplane into the ground. The student was killed.

"Everyone makes mistakes. Nobody's perfect. You can't win every time." The old excuses sound a little bit hollow now because the error that caused these accidents is hard to forgive. Someone just forgot to do some simple and routine thing that would have prevented each of them.

Somebody *failed—failed* to prepare a pilot, *failed* to file a piece of paper, *failed* to establish sufficient space, *failed* to plan, *failed* to correct, *failed* to observe air traffic rules, *failed* to properly check out a student pilot, *failed* to discover someone else's error, *failed* to recognize, *failed* to notice, *failed* to obey.

You ask him why and the sad fact is he doesn't know why he failed this time to do some simple, required thing he has always remembered to do before. He can say nothing to excuse himself except, "It slipped my mind. I meant to. I thought I had. I usually do but this time I forgot." It all sounds trite. It's commonplace. Forgetting is man's oldest ill. It began in the garden where Adam forgot, or was it Eve? We can't seem to remember now.

What's the prescription for this complaint? It seems as trite as the excuses when you write them down. *Watch yourself. Stay on the ball. Check and double-check. Remember that somebody's life is in your hands. Think! Stay alert* and *Plan ahead.* But how do you do the simple thing that all of this describes. How do you make yourself remember not to forget? Is there a simple trick, some short cut to a perfect memory? A two-dollar book you can read that will free you from carelessness?

The answer, of course, is a genuine Alpine echo of the original, heartfelt, mournful *no*.

Then maybe you'll settle for some common-sense but slightly prosaic advice. This comes from the experts, a handful of men we've run across who haven't yet forgotten when the chips were down. Why haven't they failed? Let each of them speak for himself about the sort of thing he tries to avoid:

INSTRUCTOR: "I keep reminding myself that each of these boys is green as grass. I try to anticipate for them all the rough things that ever happened to me or to anyone I ever knew."

OPERATIONS CLERK: "When-

Chicks !

ever I pick up anything the pilots or anybody ought to see, I never just put it down. I put it where it belongs, where I know they'll see it. That way I know I won't forget."

FLIGHT LEADER: "You have to remember that anything can happen and that it usually does. You have to look forward to the worst. I try to take everything into consideration, even the little error the other guy might make."

FLIGHT LEADER: "Whatever happens, you have to have a plan."

INSTRUCTOR PILOT: "I go on the assumption that if a mistake can be made, the boy I'm riding with will make it."

CREW CHIEF: "I check it. Then I go back and check it again. I try to outguess them. It gets to be a kind of game. I never play this to lose."

TEST PILOT: "In this business you can't afford mistakes. Whenever I get into an airplane I check everything, then I go around and check it all again. Always, no matter what I'm going to do, I try to remember every step in the process before I begin. You have to practice. You have to be sure. You can't just bluff these airplanes we're flying now."

But the best advice of all comes from a worn old sergeant who bosses ground crews on a nearby fighter base. "You take chickens," the sergeant said in an affable voice. "If the ordinary barnyard chicken isn't the most stupid animal that ever wore a pair of wings, then I don't know. Unless," he admitted, "you want to talk about people for a while.

"Let's stick to the chickens. It's easier that way. You ever watch a fat old hen walking her brood across the yard? She knows all the rules. And yet they say that chickens don't have any brains. It says so right in the book. Well, maybe so. But that old hen doesn't give her chicks a chance to prove how true this is.

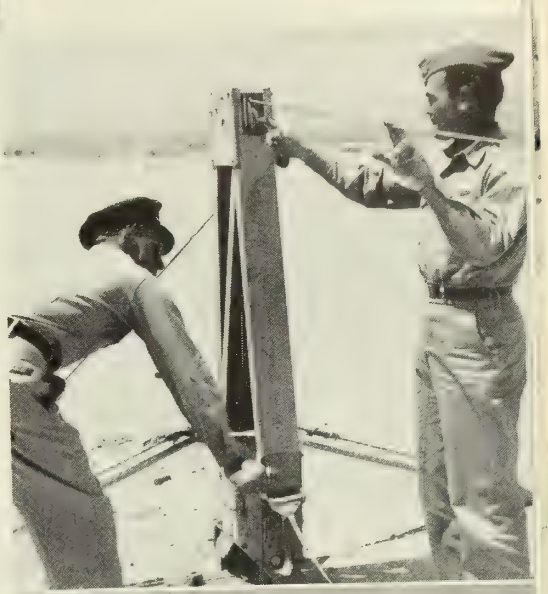
"She clucks and nudges and beats her wings; she hovers and leaps and worries them on. She watches 'em every step of the way from wherever she found them to wherever it is she wants them to be.

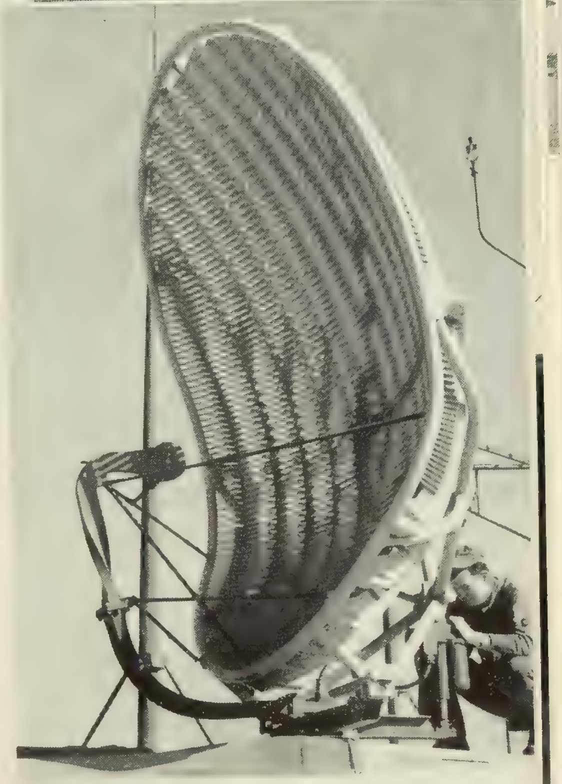
"That's what you've got to do with people," he said, reflectively, aiming a wad of tobacco at an approaching fly. "You've got to study them all the time, watch them," he spat and the tobacco flavored fly dropped to the ground, another casualty in man's war against stupidity. "Yes, sir," the sergeant continued, "no matter how smart they seem to be, you have to assume your boys are pretty stupid, just like the chickens." He shifted his plug and carefully scratched his graying head.

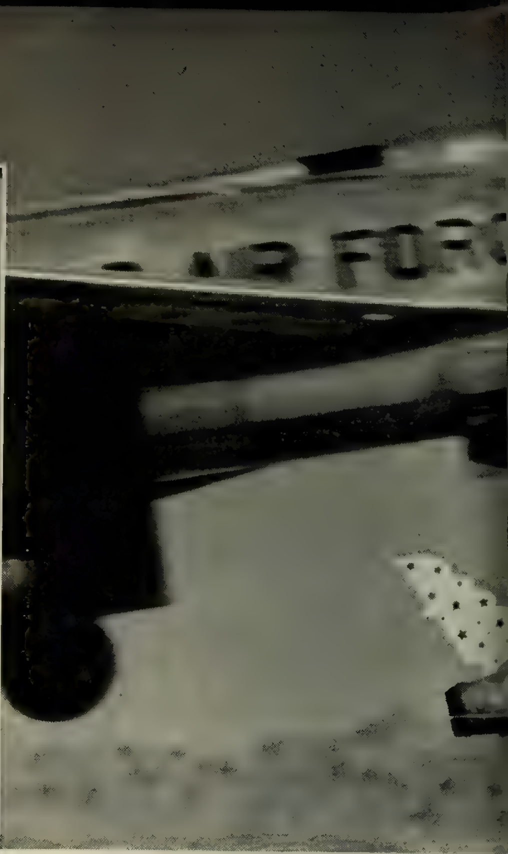
"You've got to be just like that old hen," he stated thoughtfully. "You've got to look after your own. If you really want to keep them out of trouble, you've got to look after them all the time. No matter what mistakes they want to make, what they're doing or which way they run, you've got to be there before they are. That's all there is to it," he said, cracking his knuckles and shifting his plug again.

"If you want 'em to get where you know they've got to go, you've got to take care of your chicks. Because, for all you know, they'll never make it on their own. That may not seem fair to chickens but it is," the sergeant firmly concluded, nodding with his conviction now. "At least," he said, "it's the only assumption you've got any right to make." ▲

Oversights resulting in losing a pilot or an aircraft just shouldn't happen. If you are the leader, remember the welfare of the troops is in your hands.







Newspapers next morning read something like this: ". . . World's first supersonic precision team, flying their four red, white and blue 'Century Series' fighters, performed loops, rolls, vertical U-turns, cork-screw rolls and other spectacular maneuvers in a closely-knit diamond formation, wingtips overlapping, maintaining a scant five-foot separation at speeds ranging from 150 to 750 knots."

You've seen them? So have we—several times. After having watched a few of their shows, we get almost as big a kick out of watching other pilots' faces while they're watching. The big question is written all over them: "How do they do it?"

What follows is not an attempt to analyze all of the particulars but it does concern itself with one of the biggest and most important secrets to a Thunderbird show or your mission for this afternoon. Major Jacksel M. Broughton, Flight Leader of the Thunderbirds, gives you some clues on what to do while you rehearse to take over as his replacement.

I'VE HAD A terrific opportunity. During the past two and a half years I've had a chance to analyze the various problems connected with leading and building a strong flight. I am highly conscious of detailed aspects of this problem because one of my primary responsibilities is selecting and training a flight that represents the United States Air Force under show conditions.

In my job I naturally have some advantages that normally would not be available. I can, and do, screen very thoroughly each aspirant for a position in my unit. I talk and fly with them before I select them. This opportunity to be very "choosey" has impressed me more than ever with the problems, the weaknesses and the strength that a flight leader can build into his flight.

You must appreciate from the start that a flight is a vital striking factor.

A Flight Leader Speaks...!

Major Jacksel M. Broughton, 3595th Air Demonstration Flight

I'm sure you have all read of the vast strides being made in missile development. Depending on which article you choose to believe, we are told that at some indefinite time in the future pilots will be "old stuff." At the same time we are all familiar with the advances in the single-ship attack pattern. Nuclear developments point in this direction. However, for some time to come the flight is and will remain the basic means of deployment of aircraft and aircraft weapons. When we become completely automatic I don't suppose we will need articles or even magazines dealing with this subject.

The flight then must be a strong and controlled unit if it is to succeed. To accomplish its mission (whether it be air supremacy, escort or tactical support) it must be a closely knit unit and it must be forcefully led.

To lead a good flight the leader must have the burning desire to do just that. Every prominent leader I've ever seen has had the desire to be outstanding in his job. This attitude just naturally rubs off on his associates, increasing efficiency and bringing out talent. Chances are that if you possess the necessary basic talents and really want to be a good leader, you can do it. If you don't have the burning desire you will, in all probability, never progress past the mediocre stage of development.

The leader's experience and organizational ability should first show in the preflight area. The preflight, I feel, consists of much more than strapping on the parachute, getting into the aircraft and accomplishing the checklist. The leader should determine the physical make-up of his flight as far in advance as possible. Once he has done this, he should let his people in on the nature of the mission. If crewmembers can think and plan through a flight well in advance they will be more relaxed and competent when the actual flight occurs. This mental drill process is as vital as physical drill. Examine your resources for talent available, plan its use, then don't keep it a big, dark secret. Let your crew in on your plans.

When he gets into the area of specific preflight tasks, a smart flight leader finds ample opportunity to increase the know-how of his people. Don't hesitate to delegate some authority for planning. You should, of course, maintain control of details to the extent of determining the general course to be flown, time to start and related subjects. However, I feel that one or more additional flight members should be charged with preparation of maps, research of navigational aids and facilities available, fuel reserve and so on. If you'll get the rest

The flight is and will remain the basic means of deployment of aircraft and aircraft weapons.

of your people in on the act, you'll find that their interest and efficiency will increase greatly. Don't forget to double-check their preparations, or your own. Your name is still on top of the flight ladder and you are the one who assures that all planning is correct. When you have done this and when you are sure that all of your people are both physically and mentally ready to go, you have completed your preflight planning.

Two words that have been used extensively are briefing and critique. Usage, however, has not made these words lose any of their importance. Occasionally, we find a peculiar type who thinks he is too good to be bothered with these details. Those who neglect this area of flight control usually are not around too long or at least not in a position of authority. There are no two ways about it, if you are going to have an outstanding flight you must tell them what you are going to do. Then you must evaluate their performance after you are on the ground.

A good briefing need not always go into minute details. The degree of thoroughness should be governed by the talent and experience of the weakest flight member. It is folly to attempt to lead a flight unless all members know at least what you are going to do, why you are going to do it and what basic techniques you intend to use to accomplish the mission.

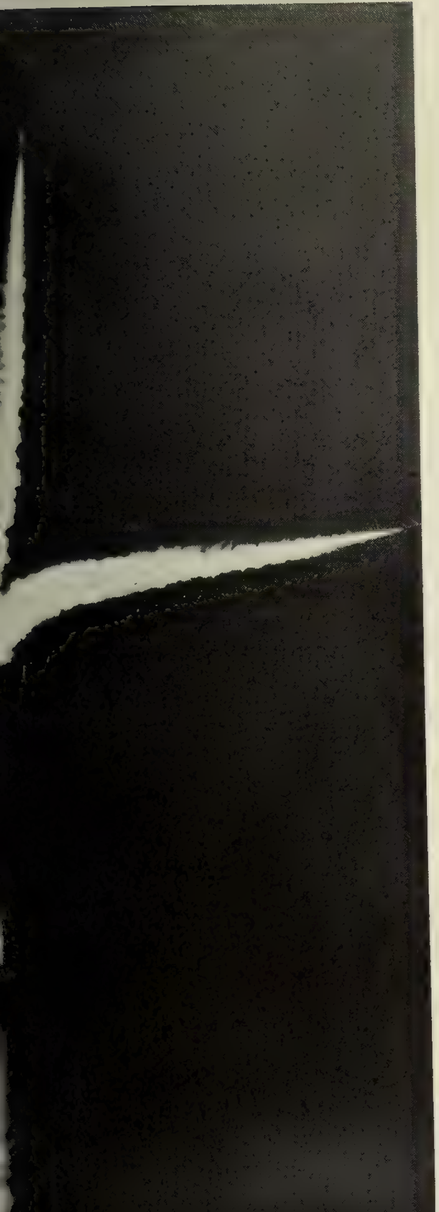
I prefer simply to talk through my flight with my troops. I find a blackboard or large paper helpful. I also make use of model aircraft in an attempt to avoid excessive talking with my hands. It seems to be easier for a wingman to visualize his actions when he looks at a model than when he looks at the back of my hand. Regardless of what I use, I still talk through the flight.

By evaluation of my past performances I've discovered that I have a few particular ways of doing things. As long as we are all people I doubt that we will ever become completely standardized. Don't fail to blend in your personal touch in briefing. Brief on what you personally intend to do. In this regard, no one should know better than you what you plan or are likely to do. Figure out what you usually do when faced with given conditions. And then give your flight the word. The better they know you, the better they are going to perform for you. So sound off.

After the flight is over, you have to tell your people how they performed. A basic evaluation of the success of the mission is the minimum acceptable critique. The more important phase of this aspect of flight leadership comes when you as a leader delve into personal performances.

If a flight member has not done well, he probably knows it. It does no good to launch into a tirade and proclaim that things are pretty grim all over. The pilot who failed, knows this already. People generally do not like to do a poor job. They want to do well and in the situation we are discussing, the poor performer looks to you for help. You must thoroughly analyze specific mistakes and make specific corrective comments.

If you can provide accurate advice the wingman will readily accept the hints you give him. It is most important that you give these hints as soon as possible. Let him have time to think through his actions. Again, mental drill is important. If the man in question can mentally go through his ac-



tions between now and his next flight, his performance will improve.

All people are basically egotistical to some degree. In other words, those who do a good job like to hear about it. If a man really puts out for you, tell him. You will reaffirm his belief that he is doing well, and you will spur him on to further good efforts. If he is an excellent wingman, then it is up to you to start looking for and exploiting his flight leading capabilities. Start building leaders now.

One area of the critique that is often ignored completely is the flight leader's re-examination of his own techniques. Re-check your practices for smoothness, efficiency and firmness. You should get a few items for that mental notebook after each flight.

The sharp flight leader knows and understands the capabilities of each flight member. In fairness to his flight and to himself, he cannot do any less. We have established long ago the fact that the flight is only as strong as its weakest member; therefore, the leader's problem boils down to bringing the weak member up to strength. This can best be accomplished by direct supervision during training flights. If a two-pilot upgrading program is possible it presents the quickest and most efficient solution. If not, then the flight leader must hold back his sharp people until the weaker ones are up to par. This is basic but important.

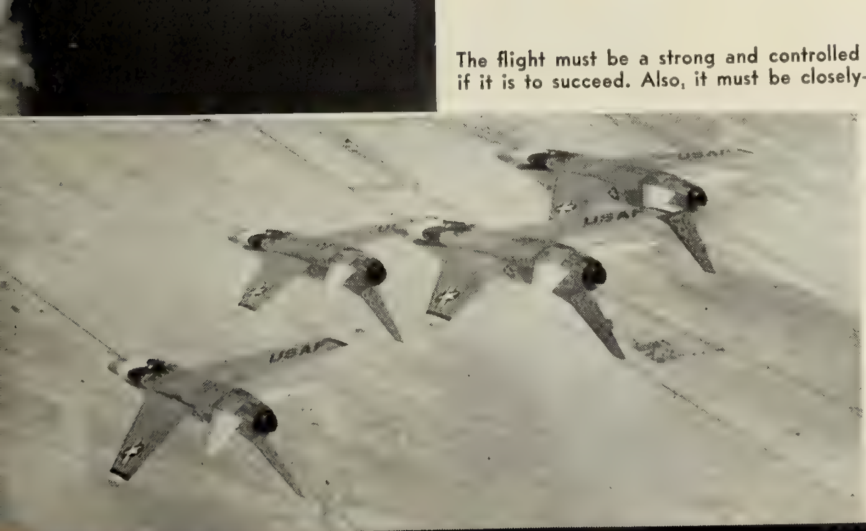
The "pretty good" pilot is a constant source of difficulty. It is quite easy for the leader to glance out at a wingman, say "Old Joe is pretty good—he can probably hack this," and promptly get himself and "Old Joe" into trouble. It is entirely wrong for the leader to place any of his charges in a rough spot by attempting something that he can barely accomplish or that overtaxes those with inferior experience. Do you remember when you were just learning? Accept the personal challenge of bringing each of your people up to the desired proficiency level.

If all flights went as planned and as briefed, there wouldn't be too much effort involved in being a flight leader. In actual practice there is an almost constant demand for inflight decisions. If you were to pick one specific area where a good flight leader earns his pay, this is that area.

Inflight decisions are made necessary by several factors but most generally by aircraft malfunctions, pilot inabilities or drastic weather changes. No matter what the cause, the requirements placed upon the leader are the same. He must first evaluate the situation and make a decision, then he must forcefully relay this decision to his flight.

When it becomes apparent that a decision is required the flight leader must first sit back and look over the possible moves. He should weigh each alternative carefully, placing appropriate value upon his own ability, the ability of his wingmen, the capabilities of his aircraft and the various aids available to him. In most cases this process cannot be excessively time-consuming, but must never be less than thorough.

When a decision has been reached, the leader must firmly relay it to his wingmen. I know of no single factor more detrimental to flight integrity than a leader who stumblingly presents a weak or vacillating decision to his troops. If you don't believe in it, how can you expect them to? Be firm, but as in your ground briefing, explain enough so that each flight member understands exactly what is expected of him. If you choose well and



The flight must be a strong and controlled unit if it is to succeed. Also, it must be closely-knit.

A trail of smoke streams from the exhaust of an F-100 so spectators can better follow maneuvers.

explain well, implementation of your decision in flight should create no problem. This facet of leadership, of course, assumes its greatest importance during an aircraft emergency situation.

Assuming that the leader has correctly trained his people in the mechanical functions of emergency procedures, and has correctly briefed on the ground, the safe and correct solution of the emergency depends solely on the leader's judgment. Each leader should have the basic outline of emergency conduct firmly in mind. He should know who he will send with the stricken aircraft, who he will direct to establish radio contact with rescue facilities and who he will direct to conserve fuel for possible capping duties. Again, firm decisions and concise instructions are a must.

In screening pilots as possible replacements for myself I've discovered that I have developed a flight leader checklist. Here's what I check:

- Does he have the "burning desire" to be the best possible leader? (If he does, his chances of success are good. If he doesn't, he has no business leading people around the sky.)
- Does he know how to plan his flight?
- Does he utilize the talent available to him?
- Can he talk to and inspire his people?
- Does he know his business well enough to conduct a briefing and critique efficiently?
- Can he make specific corrections?
- Does he give credit for a job well done?
- Does he plan for his wingmen?
- Does he accept his wingmen as his specific responsibility?
- Does he make decisions soundly and intelligently?
- Does he relay his decisions forcefully and accurately?

Why not run yourself through this checklist and see how you stack up as a leader? ▲

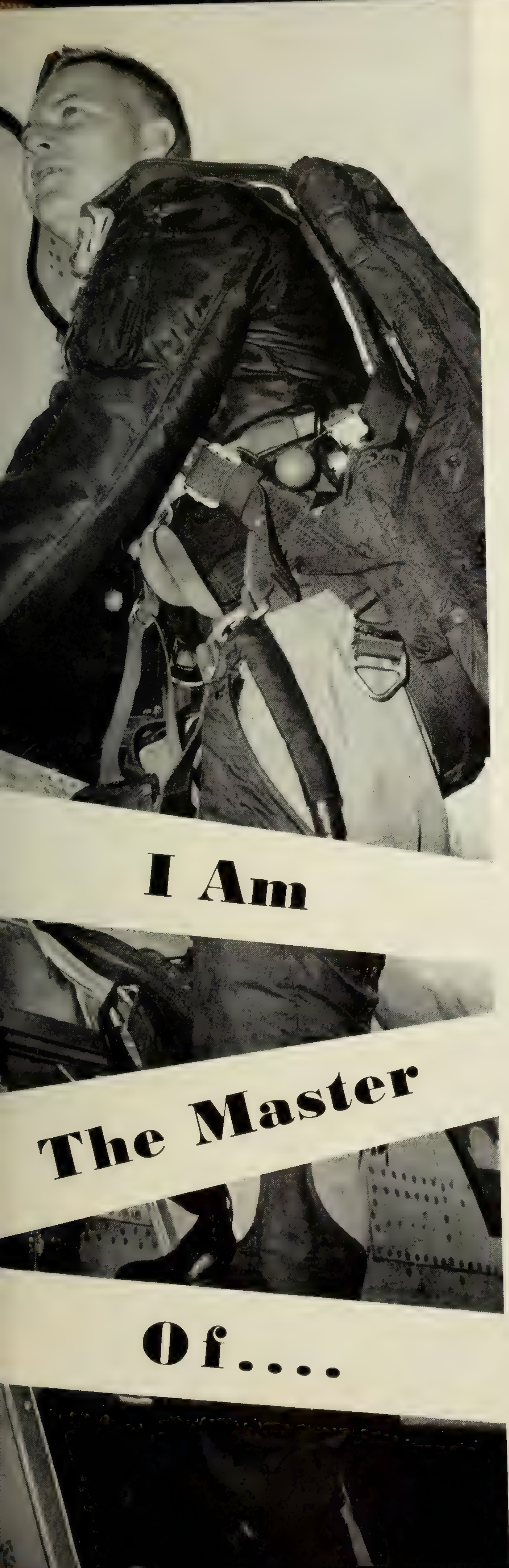
★ ★ ★

The Author

Now Commander of the 3595th Air Demonstration Flight (Thunderbirds), Major Jacksel M. Broughton, came up the professional route. Graduating from the U. S. Military Academy at West Point in 1945 as a Second Lieutenant, Jack toured Europe in '51 flying F-47s. Upon reassignment, he worked some long hard years as an instructor in jet combat crew training squadrons.

Reassigned to Korea with the 49th Fighter Group, he logged 114 combat missions during 1951. From then until two and a half years ago he served as Squadron Commander and Director of Training in combat fighter training.

In October, 1954, he was chosen as the Leader of the Thunderbirds.



I Am The Master Of....

WHENEVER YOU hear somebody say "supervisor" or "supervision," you ordinarily think of some top-management type sitting behind a large mahogany desk passing out large decisions. Decisions that may remotely or indirectly have some effect on something or somebody.

A closer look at the real meanings of the words may surprise you. It may even lead you to recognize that a supervisor, as such, is much closer to the problem. He is the immediate superior, directly responsible for giving directions and making decisions.

Let's go a little farther. The farther we go, the more evident it becomes that the true meaning of the word "supervisor" refers to your most immediate superior. In many ways, your most important boss is none other than yourself. You "oversee for direction," just like Webster says in that book he wrote.

This is something that everybody has to do for himself. But this problem of self-supervision is no easy task. Why? Simply because a more egotistical, stubborn and opinionated person can seldom be found. All of us have a remarkable combination of abilities. Despite this, even the most capable and most self-disciplined are beset by a large number of limiting characteristics which make sustained, continued self-monitoring difficult.

What supervisor, for instance, tells you to go home from a good party just because you have to fly the next morning? *You.* The only guy who can insist that you get up in time to eat breakfast and get organized for the day before that flight is you—again. You are the only supervisor who can guarantee that all the items on the preflight checklist are adequately covered.

Maybe you're different, but it takes a lot of supervising to make me crawl out of the cockpit on a cold day to check an item that I know I forgot on the walk-around. It may sound silly, but I'm the only guy who can make me do it. I'm the only guy who knows.

In the air, particularly in a single seat bird, you are both master and servant. It's a temptation to take short cuts in air procedure, or to allow attention to wander from the task at hand, a task which has become routine through hundreds of hours of familiarity. It is easy to take "calculated risks" which have been taken many times with impunity, even though you know that such unnecessary risks have resulted in disaster. Similarly, the post flight check and completion of forms after a long flight when you are tired, cold and hungry, is a matter of self-supervision or self-discipline.

Year in and year out, 50 per cent of all aircraft accidents are charged to that anomalous category "pilot error." It is in this area that the greatest remedial gains can be made in the future accident picture. It is interesting to note in this regard that only about four per cent are directly charged to supervision, meaning in this case higher authority. So it figures that self-supervision, self-discipline and strict adherence to procedures would have prevented a great many of our accidents.

Recognition by each crewmember of his responsibility for performing in accordance with existing knowledge and known procedures will go a long way in preventing aircraft accidents.

So the next time you get ready to leap, remember that the best place to look for a helping hand is at the end of your arm . . . your most immediate and important supervisor is . . . YOU. ▲

AN A/C SOUNDS OFF!

Lt. Col. Thomas L. Murphy, D/FSR

ONE OF THE most serious aspects of operating multi-crewmember aircraft is man's ability—or lack of it—to supervise, There are many definitions of supervision and yours may differ widely from mine or someone else's; however, in the final analysis I suspect that we all mean about the same thing. To make a clean break for this article I want to offer my concept of "supervision" as related to you, the aircraft commander. Plain and simple, supervision comes in two sizes, good and bad. Self-evaluation will place you in one or the other category. It is too easy, however, to fudge a little in self-evaluation, so let's do some soul-searching among ourselves and then re-evaluate what we see.

Supervision, in the case of our aircraft commanders, is pointed in one direction: to mold the material at hand into a safe machine, capable of effectively performing the assigned mission. Once you've been given the raw material, no one else can achieve the desired results except yourself. You can do it only through positive and direct supervision.

Take the positive approach to this problem of supervision by aircraft commanders. The few negative angles thrown in along the way are for spice, not to be derogatory, mind you, but to point out the evils of complacency and poor supervision. Let's take a fast look.

Building

The unit has been assigned new aircraft. You've been away to school and have hurdled the last ditch in preparation for becoming an aircraft commander. Your crewmembers have been assigned and now the arduous task of building a team must begin. They must be able to accomplish the job safely as well as effectively.

During the early phases of training you will be most concerned with filling gaps in your own education concerning the new machine. Confidence must be built up. A hay rack of forms and manuals must be continuously studied and maintained. You presume that the other members of your crew are having the same problems and are as conscientious as you are about fulfilling their obligations. Therein lies a trap in which no good supervisor would ever be caught. Questions have not been asked or answered. You have concentrated so hard on your own problems that those strangers with whom you have been flying are still strangers. Despite this, a certain amount of reliance must be placed upon their effectiveness now that solo time has arrived. Let's spice this up by throwing in one little mistake and see what happens.

The mission has been laid out. It seems like operations has included a dab of everything on the charts—day/night navigation, rendezvous and refueling, RBS, cruise control and other items of lesser magnitude. An eight-hour mission and back over the field with 30 minutes fuel reserve. We can hack that mission without too much trouble. Weather looks pretty good. Flight planning went smoothly.

If you are an Aircraft Commander, you know how to handle your bird. But are you really qualified as a leader? Try this article on for size.

If you are an A/C, take a positive approach to this problem of being a good supervisor.

Let's get this show on the road.

Everything goes as planned and we arrive over the home station VOR to terminate night celestial, fuel reserve as predicted. Switch to approach control and receive clearance to let down for start of penetration. Oxygen and altitude checks from copilot, okay. Everyone must be as tired as you are but you've got it made now. Call in over high cone as requested; one minute to start of penetration turn and descent to minium altitude. Now start descent and penetration turn. Boy, this thing unwinds on a letdown. Dials and instruments cocked all over the panel. Approach control has some weather information. Sky partial obscuration, visibility seven miles, fog —no problem. Fuel pressure warning light on. But they told me about that. You have plenty of fuel but in this machine low pressure warning lights may come on during a fast descent. Lights from that town look awful close. Hey, copilot, how about that altitude check? Approaching 10,000 feet, sir!

Now let's freeze this picture right here. The stage has been set for one of several things to happen: Abrupt contact with the ground, inflight disintegration due to an abrupt pullup

Good coordination in the cockpit is a must. As "the boss" it is your job to assure it.

After the mission has been laid on and you are on the line, your work has just started.

or we hope in this case, a near miss. Why? The copilot misread the altimeter 10,000 feet! Now don't laugh, because this has happened. It also may be a simple explanation for one or more "Cause Undetermined" accidents. The truth is that during initial crew training and checkout back at the home base, an instructor pilot rode the second seat most of the time. The copilot who was even greener than the pilot just did not, or had not been made to, realize the speed which this aircraft could lose altitude during a descent. A quick glance at the altimeter, a black night, partial sky obscuration, rapid descent, several successive turns, radio chatter and a touch of fatigue—both pilots misreading the altimeter is not so far fetched as it may seem. It happened.

Now what has being a supervisor got to do with a human nature type failure such as this? Plenty. It all started when the crew was put together and mated with their aircraft for crew training. At that particular time the aircraft commander should have begun the exacting task of acting and thinking like a supervisor. No aspect of crew ability, as a unit or as individuals, should have been overlooked or taken for granted. One of the big jobs of the aircraft commander is to determine exactly the individual performance reliability of his crew. He must use this as the basis for unit performance capability. He must know how far he can go on the strength of crewmember reports, and he must discover how much double checking on his part is required.

Specific training requirements laid down by higher headquarters are only a medium for establishing a basic minimum. You must supervise their training and their progress, and, in your own mind, determine their dependability. Don't get in a rut by thinking that being called "aircraft commander" automatically puts all things in their right perspective. This rut may turn out to be an open grave.

Check Pilots

In most USAF units a certain number of aircraft commanders are selected to perform duties as instructor pilots or check pilots. The unit commander should take careful steps to insure that pilots so designated have a keen outlook as to their responsibilities as supervisors. Total flying time, in itself, will not always tell the story. When supervising the activities of a crew, an instructor must be able to identify that fine line between *supervision* and *subjugation*. He must be able to recognize just how far to let a student go before changing his talk to physical corrective action. Let's look at a case history. This story, fortunately, has a not too unhappy ending; however (except for the God of Chance) it could have been one of the most disastrous accidents in the history of aviation. In retrospect it must be stated that supervisory error, other than that committed by the instructor pilot, also played a distinct part in this accident.

A C-124 aircraft departed home station on an IFR flight clearance for a destination approximately four hours distant. The mission:

- Route check a copilot.
- Transport 166 trusting souls and their baggage.

The pilot crew consisted of an instructor pilot, a pilot who had been checked out as a qualified C-124 copilot and the squadron commander acting as aircraft commander.

The first leg of the mission was flown by the instructor pilot and completed without incident. After loading 166 passengers and their baggage, an IFR flight plan was filed for return to home base. Now the plot thickens. With a heavily loaded aircraft, the copilot (who was getting his route check) was placed in the left seat for the takeoff and subsequent landing at home base. The qualified instructor pilot occupied the right seat. All went well on the return trip—weather VFR and no complications.

For landing it was decided to accomplish a practice GCA. In the GCA pattern the copilot (now on the controls) decided that during the approach and landing he would let the flight engineer handle the power. He wasn't exactly proficient in landing the aircraft in this manner but he wanted everything to be exactly right for the check pilot. GCA instructions were clear and everything appeared normal until about seven miles out on final. All three pilots and the radio operator stated that it appeared they were lower than usual. While descending on glide path and nearing the runway this became even more pronounced. GCA was calling "on glide path" to a maximum of 40 feet low. When passing through GCA minimums the copilot acknowledged receipt of this information and took over to land visually. He called for full wing flaps and shortly thereafter a reduction in power to 15 inches of manifold pressure. At about this time in space he realized he was much too low and started to call the flight engineer for more power. He also noticed the IP motioning with his hands to pull up the nose. Unfortunately, at this time, the aircraft made the decision and landed 100 feet short of the runway, resulting in major damage to the left gear and structural members. The crew did not realize this until later.

Upon review of board proceedings the Division Commander aptly classed the primary cause factor: "Faulty judgment on the part of the operator and his supervisor as to distance rate of closure." The supervisor (instructor) in this case, oddly enough, gave us the clue to exactly why this accident occurred. It was his personal philosophy as an instructor pilot. I quote: "I believe there are two types of instructor pilots: One who will let an individual get into trouble, then see if he can get out of it; and the other type who will never let him get into trouble and as a result never let him learn anything." End quote. He classed himself as Type One. I will not attempt to pro and con the evaluation of his philosophy at this time. However, I will stand by my earlier statement: An instructor pilot is an important supervisor. As such he must be able to know just how far he can let a student go before changing his talk to physical corrective action. In this case the IP (the supervisor) had an additional, grave responsibility placed upon him: 166 passengers. His closest and most direct supervision and action was demanded to assure their safety.

You now begin to see that being a supervisor is not always something inclusively identifiable, per se. Rather, it is often that "something" which may determine whether a flight will turn out to be routine or wind up in the statistics column. The necessary ingredients are:

- Something to supervise.
- Someone to do the supervising.
- A clean-cut delineation of supervisory responsibility.

That's your job. The first two are you and your crew. The third is supplied by the written word. You, the aircraft commander, must recognize these facts and conscientiously prepare yourself to act accordingly.

Let's review one more case history for the prosecution. It's a duzie! The Captain was a line aircraft commander. The other pilot was a Lt. Colonel from Staff. The flight order lineup designated the Captain as the Aircraft Commander. He was to run the show. But the 175 lineup showed the Colonel as the Aircraft Commander and he had signed it. The Captain wondered . . . but the Colonel said it would be that way. Trouble was in the making.

The Captain sauntered out to the aircraft and started his preflight, but it was never completed. The Colonel already had issued instructions.

A Form 14 was in the making—the carbons were in, the typewriter poised. Only the blank spaces needed to be filled in.

The show got on the road. The first half of the flight was uneventful.

But remember: Flying has been defined as long periods of utter boredom interrupted by short periods of stark terror.

After lunches had been eaten and at precisely the right time to insure an advanced case of burning indigestion the prop synchronizer quit. There was no choice but to put the props in fixed pitch. They held.

Five and one-half more hours of utter boredom passed.

The Approach

Upon approaching destination it was decided to make a practice VOR approach. Night had arrived. During the let-down the gear warning horn had to be silenced. It was switched.

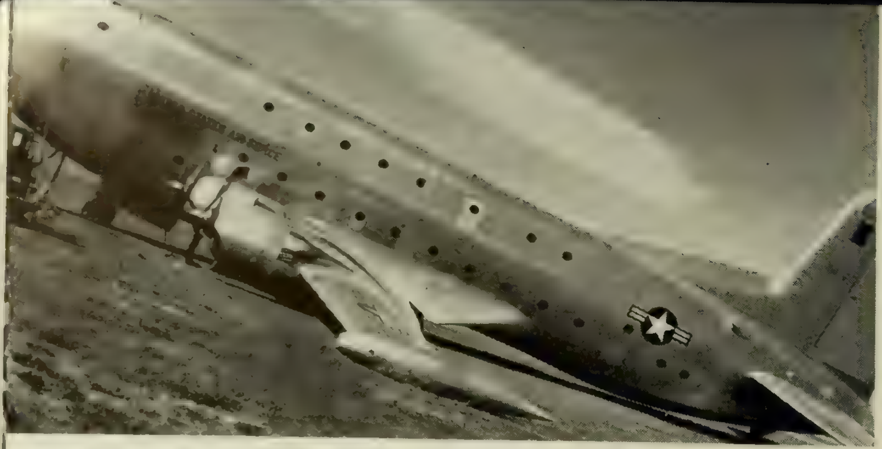
To further complicate matters the warning light in the gear handle was shining too bright. Some industrious soul had replaced a bulb of somber brightness with one of daylight brilliance. He didn't want to be caught with an AOCP. Consequently, visibility, both inside and outside the cockpit, was reduced. Quick thinking by someone produced a paper cup. A Dixie cup. This was hung on the gear handle to black out the light. A similar job of paper hanging had been accomplished earlier—a paper cup had been placed over the landing gear emergency release lever. The "door open" warning light stayed on.

The heavy hand of split responsibility and the absence of a true supervisor had left its mark on the crew. Up to now their actions have been

Every man is part of the team. Coordination and close teamwork is what you strive for.

The briefing is an all important function.

Below, one of the links in the chain at work.



Here is the price that was paid, because of no positive leadership.

governed mostly by a reluctant respect for the wishes of a superior officer. This fact had not affected the flight to any great degree up to this point. But let's continue.

The Captain planned to make a normal fixed pitch approach and landing. No problem, because he had full control of the props and two flight engineers to do what the prop synchronizer had been doing. But the Colonel suggested that the props be returned to automatic for the final approach. Unfortunately, the Captain relented and complied with the suggestion. The Colonel was reading the checklist. The next item called for "Props: 2550 rpm." The engineer advanced the synchronizer control and the props immediately surged 400 to 500 rpm. Down went the checklist. Back to fixed pitch went the props. The final approach was started. The checklist was forgotten. The tower operator was not required to call for a recheck of the landing gear and all glaring red lights nestled snugly under a black-out cover of paper cups. Utter boredom held sway for a moment—then stark terror, as a frantic grab was made for the gear handle! But the farm had been bought. There's no mistaking the mournful sound of tons of aluminum cutting an epitaph in the surface of well seasoned cement. . . . Except maybe the sound of your boss' well manicured teeth as he digs for the right answers.

The Form 14 is now filled in.

There were many factors which directly or indirectly contributed to this accident. Most of them are obvious and need no explanation. But sometimes the most obvious things are overlooked and in the final analysis stand out as the most important items of all. In this case there is little doubt but that the inability to supervise properly started a chain of events that ended in a materiel loss to the Air Force and a loss of prestige to an otherwise fine pilot. If the first "IF" had been removed from this case history, it is doubtful that the accident ever would have occurred. Aircraft commanders, supervisors, must realize this responsibility.

Reminders

We mentioned using the positive approach to this problem of supervision. What can you do as an aircraft commander to enhance your newly found status as a supervisor? A few reminders may point you in the right direction.

First of all you must realize and evaluate your own limitations. Older and more experienced pilots are almost always available to provide answers and background information. Don't be reluctant to ask their help.

When you've been assigned a crew, start immediately to evaluate each man as an individual. Study his records, become familiar with his background and try to peg his reliability. Your crew may consist of only two people—yourself and one other crewmember—or as many as 21 souls. A certain amount of reliance must be placed upon these crewmembers' capability to accomplish their jobs. Actually, your own capability will determine just how much. If you've exercised proper supervision during their growth period, the finger of doubt will not affect your own actions.

Question each crewmember about his specialty. Besides getting some idea as to progress and reliability, your own position as a supervisor will be enhanced.

What about the new copilot? He may be one of the old hands that has been around quite a while and who knows (or thinks he knows) all of the answers. Or, you may be one of the fortunate ones to be assigned a brand new second lieutenant. Now, here's your chance. A real chance to prove your ability as a good supervisor. This gent is either going to be a liability or an asset—to you as well as to the Air Force. Your efforts as an aircraft commander, a supervisor, will determine which. This angle must be considered since (whether you've thought about it or not) he's the guy who may be your replacement.

So, let's do this. Let's make him "Sir Boss" for a day. Give him the responsibility that will cause him to sit up and take notice. From the time the training mission is first laid on, let him run the show. Now, he worries about briefing times, transportation, lunches, station times and all of those little things that heretofore he took for granted. Now, he must figure the flight plan, compute the fuel reserve and correlate plans with the navigator. The Form F must be computed accurately otherwise all of the takeoff and landing data will be incorrect. Form 175 has to be filled in and filed with operations. Weather must be studied and decisions made as to the route to be taken. The gimmick is to let him make the decisions first, then, you—as a good supervisor—step in and make corrections where necessary. Of course you must be looking over his shoulder all the way. You are still the aircraft commander and as such are responsible for the conduct of the entire mission. But, progress has been made. You'd be surprised at the difference it makes to a gent who knows that he has from one to three years to sit in the other seat before he can hope to become an aircraft commander.

Now what have I tried to leave with you? I believe simply this:

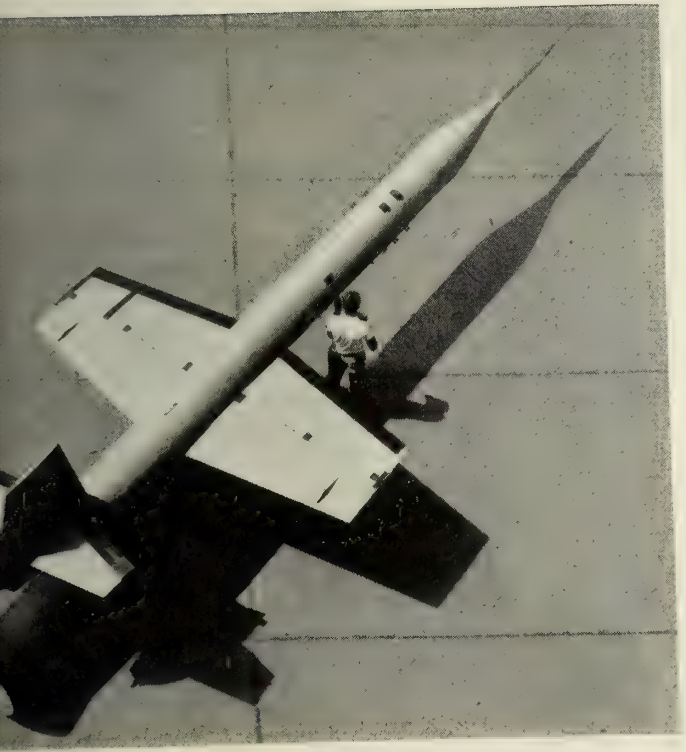
- Don't try to find or rely upon any single definition of "supervisor."
- Ask yourself "What's the problem?" Take care of that and you won't have to answer for the "IF's" sometime later.
- Rules and regulations (from a training aspect) are laid on as minimum requirements. They cannot guarantee a finished product. You, as the supervisor, the aircraft commander, must fill in the gaps.

Now that we're finished with our soul-searching, let's re-evaluate ourselves as aircraft commander supervisors. Which size are you? Good or Bad? One thing is sure—if you are in a supervisory position when the chips are down, no one is responsible but You. ▲

Keep Kurrent

NEWS AND VIEWS

Above, shows the first KC-135 during initial aerial refueling tests.



Above, after seven years of secrecy, the supersonic X-7 makes debut.

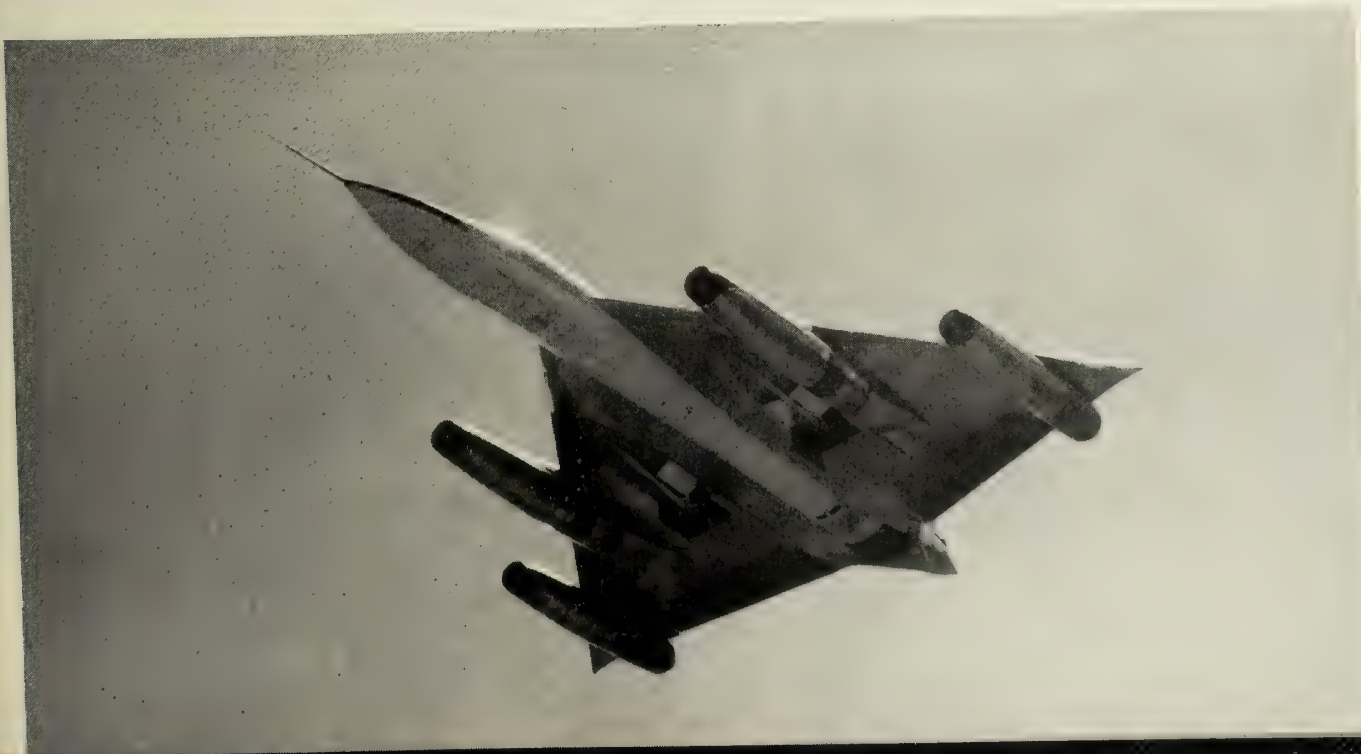
The Hustler—That is the title Convair has hung on its new, supersonic bomber, officially designated the B-58. The delta-winged aircraft was test flown for the first time by B. A. Erickson and in his words, "The flight was outstandingly successful."

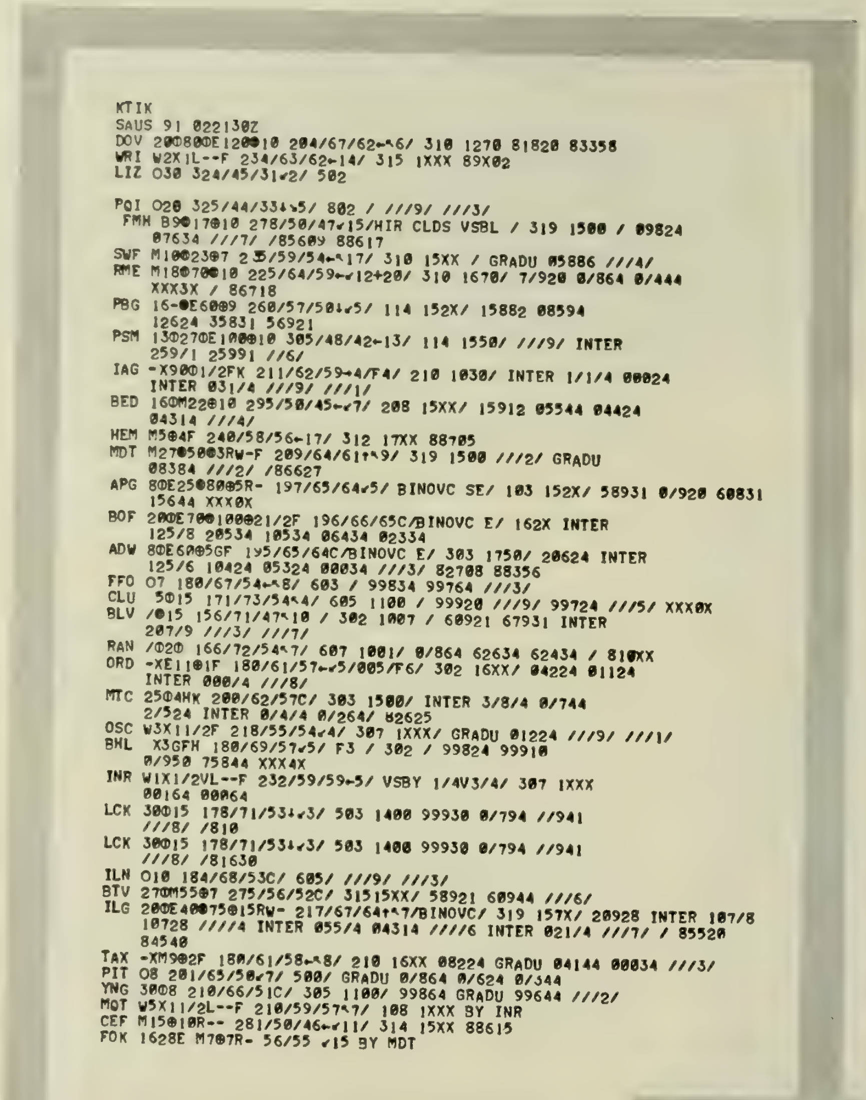
In normal operation the B-58 will carry a crew of three: the pilot, navigator-bombardier and defense systems operator. Its four General Electric J-79 engines are equipped with afterburners and mounted in separate nacelles slung underneath the wings.

The wing span is about 55 feet and the overall length is around 95 feet. Elevons in the wing trailing edges combine the control functions of conventional ailerons and elevators.

The B-58 is regarded as the first really supersonic bomber. It is designed to operate in excess of 50,000 feet.

Below, is Convair's ultra-fast B-58 shown during actual flight testing.





```
KTIK
SAUS 91 022130Z
DOV 20Φ80ΦE120●10 204/67/62←↖6/ 310 1270 81820 83358
WRI W2X1L--F 234/63/62←14/ 315 1XXX 89X02
LIZ O30 324/45/31↙2/ 502

PQI O20 325/44/33↓↘5/ 802 / ///9/ ///3/
 FMH B9⊕17⊕10 278/50/47↙15/HIR CLDS VSBL / 319 1500 / 09824
    07634 ///7/ /85609 88617
SWF M10⊕23⊕7 235/59/54←↖17/ 310 15XX / GRADU 05886 ///4/
RME M18⊕70●10 225/64/59←↙12+20/ 310 1670/ 7/920 0/864 0/444
    XXX3X / 86718
PBG 16-●E60⊕9 260/57/50↓↙5/ 114 152X/ 15882 08594
    12624 35831 56921
PSM 13Φ27ΦE100⊕10 305/48/42←13/ 114 1550/ ///9/ INTER
    259/1 25991 //6/
IAG -X90Φ1/2FK 211/62/59→4/F4/ 210 1030/ INTER 1/1/4 00024
    INTER 031/4 ///9/ ///1/
BED 16ΦM22⊕10 295/50/45←↙7/ 208 15XX/ 15912 05544 04424
    04314 ///4/
HEM M5⊕4F 240/58/56←17/ 312 17XX 88705
MDT M27●50⊕3RW-F 209/64/61↑↖9/ 319 1500 ///2/ GRADU
    08384 ///2/ /86627
APG 8ΦE25●80⊕5R- 197/65/64↙5/ BINOVC SE/ 103 152X/ 58931 0/920 60831
    15644 XXX0X
BOF 20ΦE70●100⊕21/2F 196/66/65C/BINOVC E/ 162X INTER
    125/8 20534 10534 06434 02334
ADW 8ΦE60⊕5GF 195/65/64C/BINOVC E/ 303 1750/ 20624 INTER
    125/6 10424 05324 00034 ///3/ 82708 88356
FFO O7 180/67/54←↖8/ 603 / 99834 99764 ///3/
CLU  5Φ15 171/73/54↖4/ 605 1100 / 99920 ///9/ 99724 ///5/ XXX0X
BLV /●15 156/71/47↖10 / 302 1007 / 60921 67931 INTER
    207/9 ///3/ ///7/
RAN /Φ2Φ 166/72/54↖7/ 607 1001/ 0/864 62634 62434 / 810XX
ORD -XE11⊕1F 180/61/57←↙5/005/F6/ 302 16XX/ 04224 01124
    INTER 000/4 ///8/
MTC 25Φ4HK 200/62/57C/ 303 1500/ INTER 3/8/4 0/744
    2/524 INTER 0/4/4 0/264/ 82625
OSC W3X11/2F 218/55/54↙4/ 307 1XXX/ GRADU 01224 ///9/ ///1/
BHL  X3GFH 180/69/57↙5/ F3 / 302 / 99824 99910
    0/950 75844 XXX4X
INR W1X1/2VL--F 232/59/59←5/ VSBY 1/4V3/4/ 307 1XXX
    00164 00064
LCK 30Φ15 178/71/53↓↙3/ 503 1400 99930 0/794 //941
    ///8/ /810
LCK 30Φ15 178/71/53↓↙3/ 503 1400 99930 0/794 //941
    ///8/ /81630
ILN O10 184/68/53C/ 605/ ///9/ ///3/
BTV 27ΦM55⊕7 275/56/52C/ 31515XX/ 58921 60944 ///6/
ILG 20ΦE40●75⊕15RW- 217/67/64↑↖7/BINOVC/ 319 157X/ 20928 INTER 107/8
    10728 ////4 INTER 055/4 04314 ////6 INTER 021/4 ///7/ / 85520
    84540
TAX -XM9⊕2F 180/61/58←↖8/ 210 16XX 08224 GRADU 04144 00034 ///3/
PIT O8 201/65/50↙7/ 500/ GRADU 0/864 0/624 0/544
YNG 30Φ8 210/66/51C/ 305 1100/ 99864 GRADU 99644 ///2/
MOT W5X11/2L--F 210/59/57↖7/ 108 1XXX BY INR
CEF M15⊕10R-- 281/50/46←↙11/ 314 15XX 88615
FOK 1628E M7⊕7R- 56/55 ↙15 BY MDT
```

Above, the detailed sequence comes in every three hours. Right, at 20 minutes intervals, you get any weather changes.

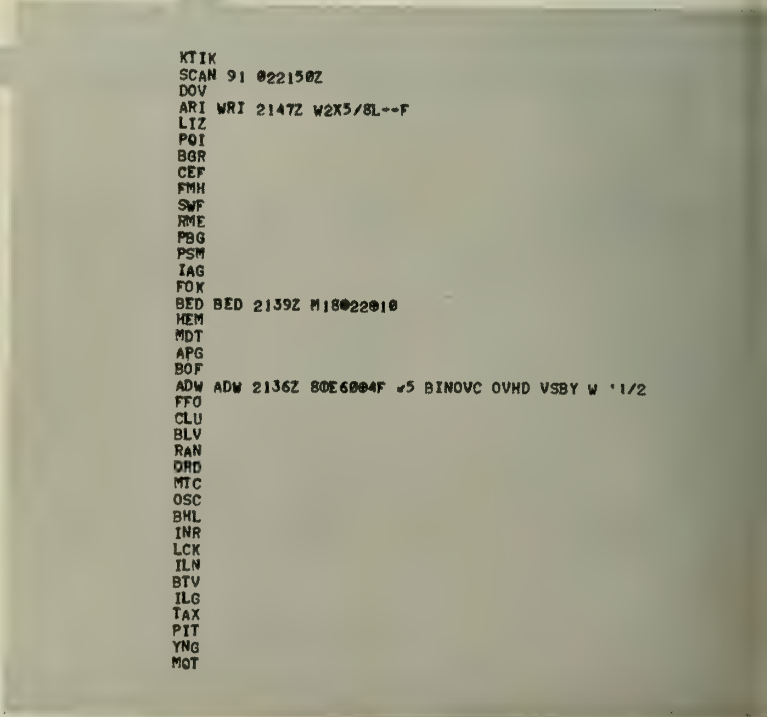
IN THE DAYS of old, when the knights of the air were somewhat younger — if not bolder — your friendly weatherman sent you a full weather report on the hour. This was very convenient, particularly as he supplemented this with special reports when the weather changed in between times.

As you've undoubtedly noticed, if you've visited your local soothsayer's shop recently, something new has been added. There is now an entirely new system of weather reporting designed to give you a current observation every 20 minutes. This system is known as the "20-Minute Weather Reporting Program," and this article will clue you in on why a change was necessary, how it works and how it helps you. But let us start at the beginning:

Weather

It is well known that the Wright Brothers really started something when they dreamed up their flying machine. In the process, they generated a sideline revolution in the weather business or, to give it the two-dollar title: The Aeronautical Meteorology business.

The early iron birds flew low, slow and for short distances, so it really wasn't necessary to exchange weather data for long distances nor in very great detail.



```
KTIK
SCAN 91 022150Z
DOV
ARI WRI 2147Z W2X5/8L--F
LIZ
PQI
BGR
CEF
FMH
SWF
RME
PBG
PSM
IAG
FOK
BED BED 2139Z M18●22⊕10
HEM
MDT
APG
BOF
ADW ADW 2136Z 8ΦE60⊕4F ↙5 BINOVC OVHD VSBY W '1/2
FFO
CLU
BLV
RAN
ORD
MTC
OSC
BHL
INR
LCK
ILN
BTV
ILG
TAX
PIT
YNG
MOT
```

The meteorologists got together and came up with a method for providing a much more current look at the weather.

Streamlined Sequence

C. J. Callahan, Headquarters Air Weather Service

The low and slow birds have been replaced by high-flying speedsters.

When the baling wire-adhesive tape days drew to a close, it became apparent that there was a requirement for more and more weather data from greater distances. The solution was to link up the reporting stations by teletype circuits. These operated under somewhat of a built-in handicap—there are, unfortunately, only 60 minutes in an hour.

You'll recall from your early adventures in arithmetic that if your teletype runs at 60 words per minute you can send, or receive, a maximum of 3600 words in an hour. A "word" is used here as a group of five teletype impulses, be they letters, figures or symbols. This places maximum circuit capacity at just 18,000 impulses per hour.

Now this was generally satisfactory in good weather but when the elements soured, a great many specials were taken, and the total, if sent, was more than 18,000. The net result was obvious — anything over 18,000 simply couldn't be sent and sadly enough just when you needed the information the most, in bad weather!

The wily weathermen began to search for a solution to this and the first answer you've probably guessed—run the teletypes faster. They decided to run them at 100 words per minute instead of 60, a theoretical increase in capacity of 66 per cent. However, this required the development of new machines, which isn't done overnight.

By the time the speedster models were about ready, demands for data had increased to such a point that even they would'nt help much. Something else had to be done.

A long series of interdepartmental conferences failed to come up with a common agreement. Actually, the civil circuits were not hurting as much as the military—they had more lines so the problem wasn't as acute. Still, the Air Force decided to go ahead with the "20-Minute Weather Reporting Program."

Here's how it works. The Air Force observer is keeping a constant watch on the weather at his station. Every 20 minutes he is required to indicate any significant changes that have occurred. We emphasize the word "indicate" because if nothing has changed, only the call letters of his station appear on the teletype. The professors call this "Management by Exception."

Now let's go through the full cycle. Every three hours each station sends a full weather sequence report, just like you used to get every hour under the old system. The "scan" comes in at 20-minute intervals and operates like this:

A monitor station (Tinker) sends a station's call letters. If the weather has changed since the last full report (or the last scan), the station has two seconds in which to send its new report—not a full one but enough operational meat like ceiling, visibility and wind, to let you know what has changed. If the weather hasn't changed, the station sends nothing; the monitor waits two seconds and then sends the call letters of the next station on the sequence. This is repeated every 20 minutes for three hours when all stations again send full blower reports.

Brother, this is one way to guarantee that you're never more than 20 minutes behind current weather. Even if the station has sent nothing for seven scans (2 hours and 40 minutes) you know that the conditions reported on the last three-hourly sequence haven't changed. Those specials which couldn't be transmitted are a thing of the past: you get more information, while the weather man, blessed with more (and current) data readily available, can do a better job on your flight forecasts.

This application of the principle of "Management by Exception" has been accompanied, as is usual with innovations, with a certain amount of confusion.

The main difficulty doesn't lie in the system itself. It's the physical handling of the teletype paper that causes some bugs. Though no standard system for processing the data has been established as yet, several systems have been developed by various ingenious weather types and seem to work very adequately.

If you've had trouble finding what you want, ask your local weather officer to check you out on how he handles the paper. As is also usual, a few people didn't get the word, but recent "All Points Bulletins" should clear this up quite rapidly.

In short, the new system permits you to stay within 20 minutes of current weather. Under the old procedures you could be as much as an hour behind it. ▲

Do all of your boys know what to do when a barrier engagement appears imminent? If not, they have no one to blame but themselves . . . and you.

Stop of the Century

MORE THAN 200 Air Force aircraft are flying today although at one time each was headed for a certain crash. These birds, because of landing long or aborting a takeoff, were headed for the boondocks when, at the last moment, they were snatched to a sudden stop. We are referring, of course, to the landing barriers that are perched at the end of some 300 Air Force landing strips.

These barriers carry a tab of about $10,000 each. Figure this cost against that of over 200 airplanes and you have little difficulty in justifying the barriers' existence.

The standard USAF MA-1A runway overrun barrier is the outgrowth of a similar system developed and tested in Japan during the Korean conflict. The original system proved successful in arresting most of the jet fighter types in service at that time. The runway barrier in current use is basically the same design with some improvements. The improvements were necessary because fighter aircraft of today have grown considerably in size and gross weight and have higher landing speeds.

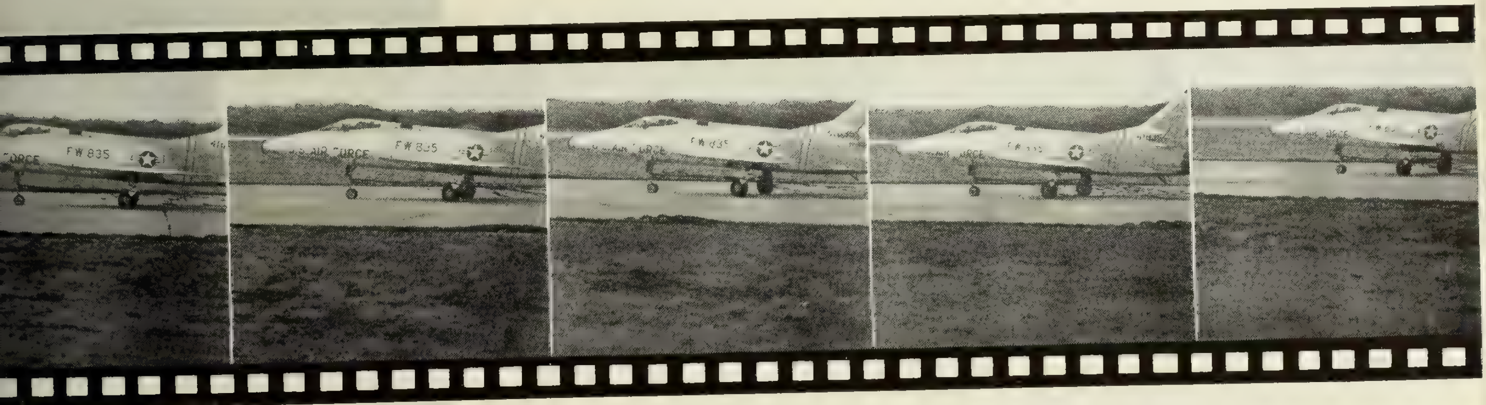
For those interested in the actual construction and design of today's barrier, here is a fast rundown. The barrier is made up of two remote-controlled, pneumatically-operated stanchions, one on each side of the runway. They support a nylon rope at a height of 38 inches above the runway. The nylon rope is attached to the stanchions by release assemblies fitted with shear pins that fail and allow the arresting gear to be actuated to catch the struts.

The rope may be described as the trigger for the arresting system. Attached to the nylon rope are 25 lifting straps, made of nylon webbing, 12 on each side of the runway centerline. The other end of each lifting strap is fastened to a 7/8 inch diameter steel arresting cable. Movement of the aircraft through the nylon rope causes the lifting straps to lift the arresting cable into position to be engaged by the main gear. The arresting cable is attached to the stanchions at each end by a shear device which fails when sufficient tension is placed on the cable. This cable is further attached at each end to a length of chain lying off the runway. As the airplane continues down the runway, the chain is dragged along, gradually slowing the aircraft down. The chain weighs approximately 55 pounds per foot for the first 90 feet, and then the weight is doubled for the remaining 360 feet. The whole trick is getting the aircraft main gear to engage the arresting cable.

The Catapulting and Arresting Section at WADC's Equipment Laboratory, heads up the Air Force barrier program. The problem of arresting high performance airplanes during ground roll emergencies is a very real one. Each new aircraft design presents its own special engagement problem as landing gear spacing, fuselage clearance, and external store configurations and locations all affect the engagement capability.

In previous issues FLYING SAFETY has covered the tests on the

Here are some shots of the F-100 and landing gear struts. The tests were run at various speeds and in various configurations to determine the adaptability of the aircraft to the standard MA-1A barrier. The aircraft proved itself okay.



F-86, F-84 and others. In this one, let's look at the F-100. It turns out that the first of our Century Series aircraft fares pretty well after tangling with the barrier. Your chances are greatly enhanced, however, if you keep a few things in mind.

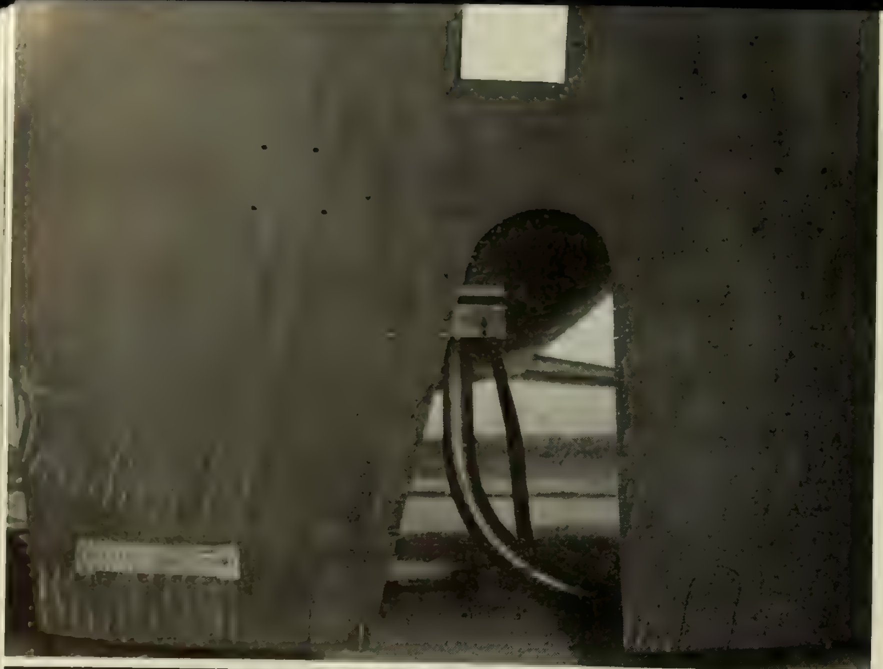
It is rather reassuring to know that somebody has performed a very comprehensive barrier testing program on the bird you fly. They determine the adaptability of the airplane to the barrier and the barrier to the airplane. Therefore, just about everything is tried. The object, of course, is what can you, the pilot, do to better your chances for a successful barrier engagement?

External Tanks

In all of the tests conducted with external tanks, not a single aircraft made a successful engagement. One tactical unit has sent in a report concerning an F-100 carrying two external tanks and successfully engaging the barrier. This, however, is the exception and exceptions don't make the rules. The tests conducted at WADC prove that retention of tanks greatly reduces the odds for a good catch. This applies to all external stores. The rule says: The aircraft is considered unsatisfactory for barrier engagement in the external stores configuration. So get rid of 'em.

This wasn't a hit or miss proposition. Realizing the hazards associated with jettisoning external stores, an attempt was made to develop a method of engaging the barrier by means of hooks attached to the dive brake door. With this modification the cable could be caught by the dive brake with the external tanks in place. However, the door is not structurally designed to withstand the barrier engagement load. Therefore, the "get rid of 'em" rule remains.

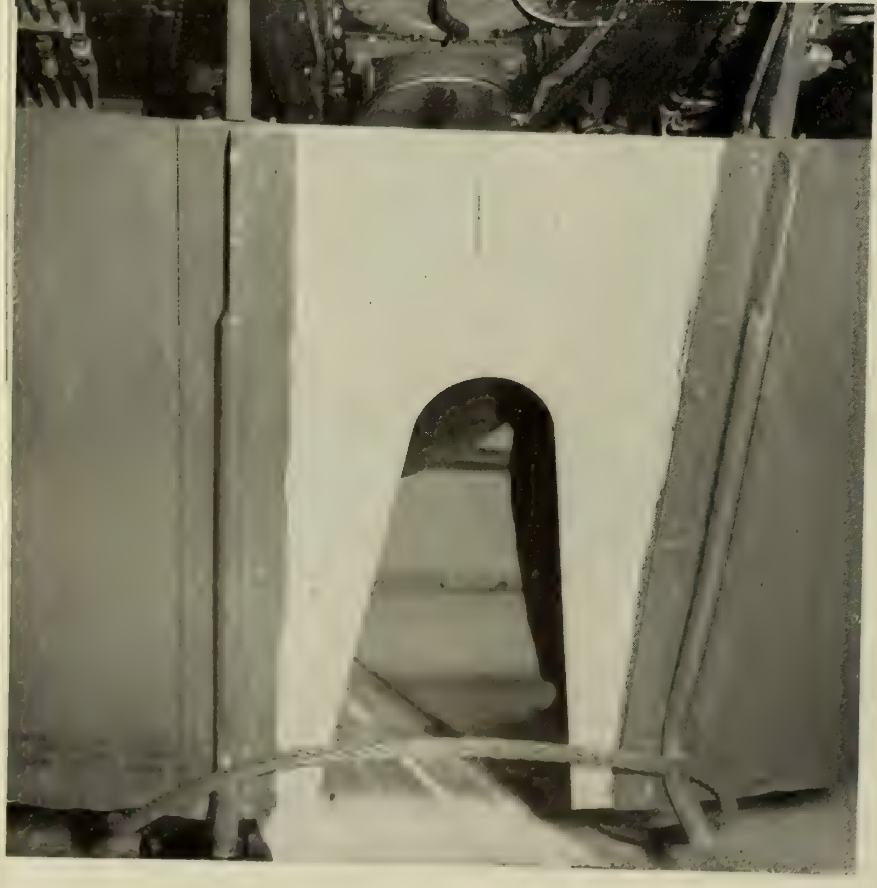
As in the T-Bird, an open dive brake, as now installed on the '100s, will louse up the whole operation. The arresting cable comes up, hits the door and neatly goes down and under the main wheels. Result: *Nothing!* So,



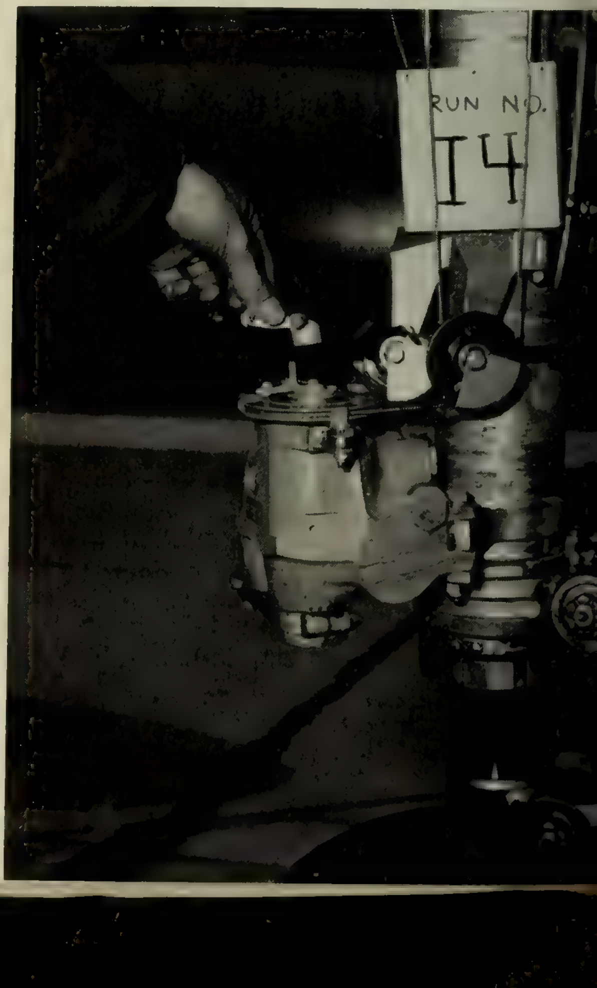
it's speed brakes up and tanks off to insure an engagement.

Clean

In the clean configuration, the barrier engagement results were very satisfactory. The highest speed used was 92 knots and the engagement was a satisfactory one with a runout of about 1000 feet. Normally speaking, the higher the speed the better the engagement . . . up to a point. One of the problems of an extremely high-speed engagement is not having enough chain to stop the aircraft. As



At left, notice the cable marks on the speed brake door and the hook modification. Below, is the obvious reason for possible loss of nosewheel steering after engagement.



a result, a successful catch is made, but the aircraft proceeds out of the overrun with resultant damage. Studies are being made now to determine the feasibility of adding more links of chain on each side.

Low Speeds

One of the reasons for testing is to determine the low speed cut-off point. In the F-100, for example, the low speed cut-off point fell between 33 and 28 knots. At 33 knots the engagement was successful, while at 28 knots it was unsuccessful. As such, somewhere below 33 knots you can not expect a good catch. It was noted throughout the low speed engagement program that the shear devices which retain the nylon horizontal straps across the runway, failed to shear simultaneously; in many instances one side would shear while the other held throughout the engagement. This resulted in a slight yawing after engagement. The pilot was able to correct the yaw with nose gear steering in each case. At engagement speeds of 60 knots or above, this condition was not apparent.

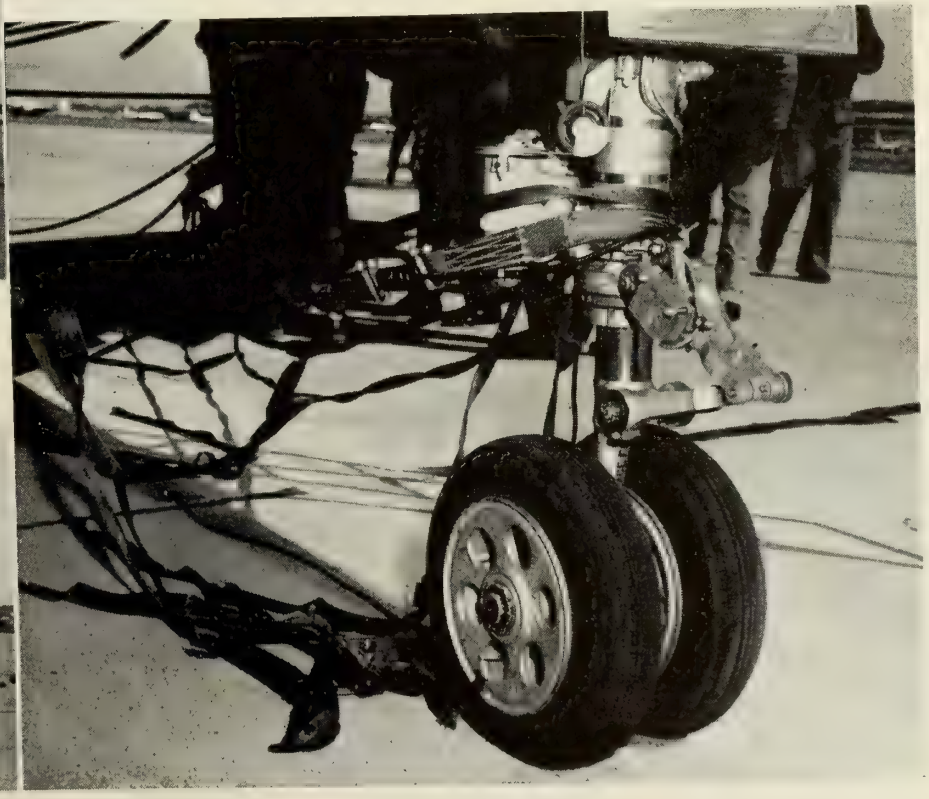
During several of the higher speed engagement tests the mechanical hydraulic and electric components of the nose gear steering system were damaged. As a result, there was a loss of nose gear steering. Although it may not happen, it is always a possibility.

For planning purposes, figure it this way:

- The F-100 can be arrested successfully in the clean configuration.
- It cannot be engaged with external stores installed.
- The dive brake should be closed.
- Expect loss of nose gear steering upon contact with the barrier. ▲

Above, are the engagement results at 38 mph.
Below, the aircraft engaged—doing about 54.

The nose gear strut actuates the webbing and acts as the trigger to set off the mechanism.



REX SAYS

THE CAPTAIN of a Viscount airline type reports that shortly after takeoff, when at a height of 12,000 feet, the first officer requested a glass of Alka Seltzer from the stewardess. Upon receiving the drink, the aircraft bumped in turbulence and a very small amount of the liquid was spilled on the pedestal. The captain requested a cloth immediately but before it could be obtained, one inverter switch had shorted out, blowing the fuses. The area was dried rapidly, but the second inverter also shorted out. The aircraft was flying in the clouds and a turn was made to return to the point of departure. An attempt was made to activate the standby inverter but it had also been shorted out. The captain was able to locate a break in the clouds and a successful landing was made.

REX SAYS*—This account was received from the Royal Australian Air Force, who reported that this incident reveals a weakness present in practically all modern aircraft. In aircraft such as the Convair 240 and Douglas DC6 it is possible to cause propeller reversing in flight by spilling liquid over the control switches on the pedestal. There is only one answer, of course. Keep liquids out of the driver's compartment.*

★ ★ ★

DURING a recent test, the Missile Test Center of Ground-to-Air Interceptor Missiles picked up an unidentified target adjacent to the restricted area. Its presence was detected visually and not until a few seconds after a test missile had been launched. This aircraft was in real danger. If the missile had not malfunctioned, there is a strong possibility that the aircraft would have been destroyed. There have been other instances of unidentified aircraft flying at very high altitudes through these restricted and warning areas. Apparently some pilots of high performance aircraft feel there is not much danger in flying through these areas at extreme altitudes. This is not true. Pilots must realize that there is no safe passage through such an area unless properly cleared.

REX SAYS*—You may be flying the hottest aircraft around but you ain't seen nothin' 'til you see one of those missiles perform. So, regardless of your altitude, regardless of your speed —one of those jobbies will get you if you don't stay clear.*

★ ★ ★

WHILE ON a cadet orientation mission I made a normal pitchout for landing. On the roll-out, the gear and flaps were lowered and the turn to base started. Upon checking the gear handle, I found that the handle would not lock in the down position even though I had a safe gear indication. Three attempts were made during this part of the pattern to lock the handle, but with no results. So a go-around was performed.

After climbing to altitude once more, the aircraft was slowed down and approximately six more attempts made to lock the handle. I notified the tower of the difficulty and requested the crash crew to stand by, and also for gear pins to be brought to the end of the runway.

I instructed the cadet in the back seat to hold the gear handle down during landing and after-landing roll. A normal pattern was made and upon flareout and reduction of power, I too held the gear handle down. After a normal touchdown and landing roll, the aircraft was stopped at the end of the runway and gear pins inserted. The aircraft was taxied to the parking area without further incident.

It is my recommendation that the importance of checking the gear handle every time in the pattern be reiterated to all T-33 pilots.

It is also noteworthy that this same message has been presented in Flying Safety Magazine. After two years of T-Bird flying, that gear handle check finally paid off for me.

REX SAYS*—You just can't be too careful when it comes to herding Uncle's Birds. Like the man said, "That gear handle check finally paid off for me."*

Thanks a lot for the story. It is real live incidents like this that pound home the importance of some of the seemingly insignificant, inflight checks. Congratulations on a real fine, heads-up job.

★ ★ ★

AN F-100D aircraft was involved in an incident which uncovered the following information:

The aircraft aborted takeoff at approximately nose lift-off speed (135 knots), after covering some 3400 feet of an 8700-foot runway. Gross weight was approximately 30,000 pounds.

The drag chute was deployed and the throttle stopcocked. The drag chute streamered and provided no braking action, yet the aircraft was stopped successfully in approximately 3100 feet with normal braking action. This F-100 was equipped with the anti-skid braking system. No damage was done to the aircraft nor was there any evidence of excessive use of brakes (flat spots, skid marks or smoking brakes).

"Gridley, I suspect that you failed to grasp my point on closer supervision!"

Information like this should be brought to the attention of F-100 pilots in all commands. The continual publication of data such as this makes more information available to the pilot and promotes the cause of flying safety in all aspects.

REX SAYS*—It is always good to get the word on incidents such as this, especially when it involves a relatively new bird. So often a new aircraft gets so involved with rumors, that before you know it, it has a real bad reputation. Don't believe half the stuff you hear at happy hour. Just get the facts, man.*

★ ★ ★

TWO PILOTS in a T-33 took off on a routine flight. Approximately 10 miles from their destination, it was noticed that the Airspeed Indicator and Altimeter were not functioning properly. An immediate call was made to Radar Approach Control Center. The closest GCI site picked the '33 up on radar and scrambled an F-89. GCI vectored the F-89 to intercept the distressed T-33 and they joined up. The weather was reported as partially obscured with ¾ mile visibility in fog. With the T-Bird flying wing, the F-89 penetrated, broke out and led the '33 down to the runway. The F-89 pulled up and came around and landed.

REX SAYS*—That, gentlemen, is what's known as cooperation. It just goes to show you that if you get into a pinch and let somebody know about it right away, you can be helped. This deal of waiting until you are down to a dram of fuel before asking for assistance won't hack it. Congratulations to all hands for saving the T-33.*

★ ★ ★

A T-BIRD accident was just barely averted—thanks to an alert tower operator. While making a modified flameout (practice, amen) pattern, the pilot placed the gear handle in the down position and checked the indicators for wheel position. Assured that there were "three green" and pressure, the pattern was continued. As the bird came over the fence, the tower angel called to "pull up" (you guessed it), no gear! A successful go-around was made with no damage other than a slight scraping of the dive boards.

The next landing was made a little higher from the ground. After shutdown, a quick check was made on three birds and all seat positions had microphone wires between the gear handle and the left console and in some cases the wires were wedged tightly.

All wires have since been relocated to come over the back of the seat.

REX SAYS*—Whew! You can't come much closer than that to pranging a bird. Maybe I've misunderstood the trouble. I don't quite get the picture on this misrouted wiring but I'm glad that you've fixed it, whatever it was. One thing about a deal like this, if everybody complied with the (here we go again) Dash One. . . . It says, "Gear handle down and JIGGLE." If it is in the down detent, that handle isn't going any place. IT'S IN THE DOWN POSITION . . . period.*

★ ★ ★

WHILE ON my first instrument ride the instructor said he had the aircraft and wiggled the stick. He then demonstrated the use of several instruments. About five minutes later, he said, "You need a little more back pressure on that maneuver." At that time I had my hands in my lap. I don't know how long I was supposed to have been flying.

REX SAYS*—Who's on first?*

★ ★ ★

AN INSTRUCTOR pilot entered an inadvertent spin in a B-25. He was trying to demonstrate unfeathering procedures without the use of the feathering motor by slipping the aircraft to start the propeller turning. Experience is a good teacher though, he now recommends that everyone use the normal procedure.

REX SAYS*—If the Baker two-five was built to go sideways, they'd have pointed the seats that way.*

After the Point touchdown

Captain Harry J. Tyndale, 666th AC&W Squadron

Considering the pace of today's world, it takes a lot of effort to keep up with the refinements in this flying business. A good boss knows this.

"IT'S NO GOOD, sir, you'd never stop the bird."

"That's a matter of opinion, Captain." There was obvious displeasure in Colonel Kelly's tone as he answered Captain Johnson.

"We won't lose more than an hour, sir. Just put the boards down and keep a high setting. If the runway dries out in the meanwhile, we might try it earlier."

The Colonel didn't bother to acknowledge. What he had to say, he'd say on the ground.

There was no further discussion. In the locker room Captain Johnson could read unhappiness on the Colonel's face. He buttoned up and made a hurried but silent exit. Bill Johnson took the leisurely approach, deep in thought about the factors behind the decision he had just imposed upon his base commander.

It came as no surprise when Captain Johnson was summoned to the office of the Director of Operations.

"Good afternoon, Bill," greeted Major Ham, as he returned the salute. "Sit down," he said, offering a chair with a wave of his hand. "What's the Old Man so upset about?"

"I suppose it's customary for the ranking man to get indignant in any difference of opinion," answered Captain Johnson. "Did he explain the situation to you, sir?"

"In a sense," answered Major Ham. "Of course it was the Colonel's opinion that I had heard. On the surface, it's pretty serious. He wants me to pull you from the IP list."

"Maybe you'd better, Major, because I won't do any different the next time."

"Well, before I can do anything, I've got to find out what happened. Right now I'm dealing with a case of hurt pride, and since it involves my Commander, it's a big case. As I understand it, you overrode his opinion and flatly refused to let him land. Is that the right dope?"

"That's it, sir. If I wasn't there I'm sure that he would have landed. And I'm equally sure that I'd be out there in the rain investigating the accident."

"Could you prove your judgment on paper, Bill?"

"Yes, sir, at least to a reasonable man of average savvy."

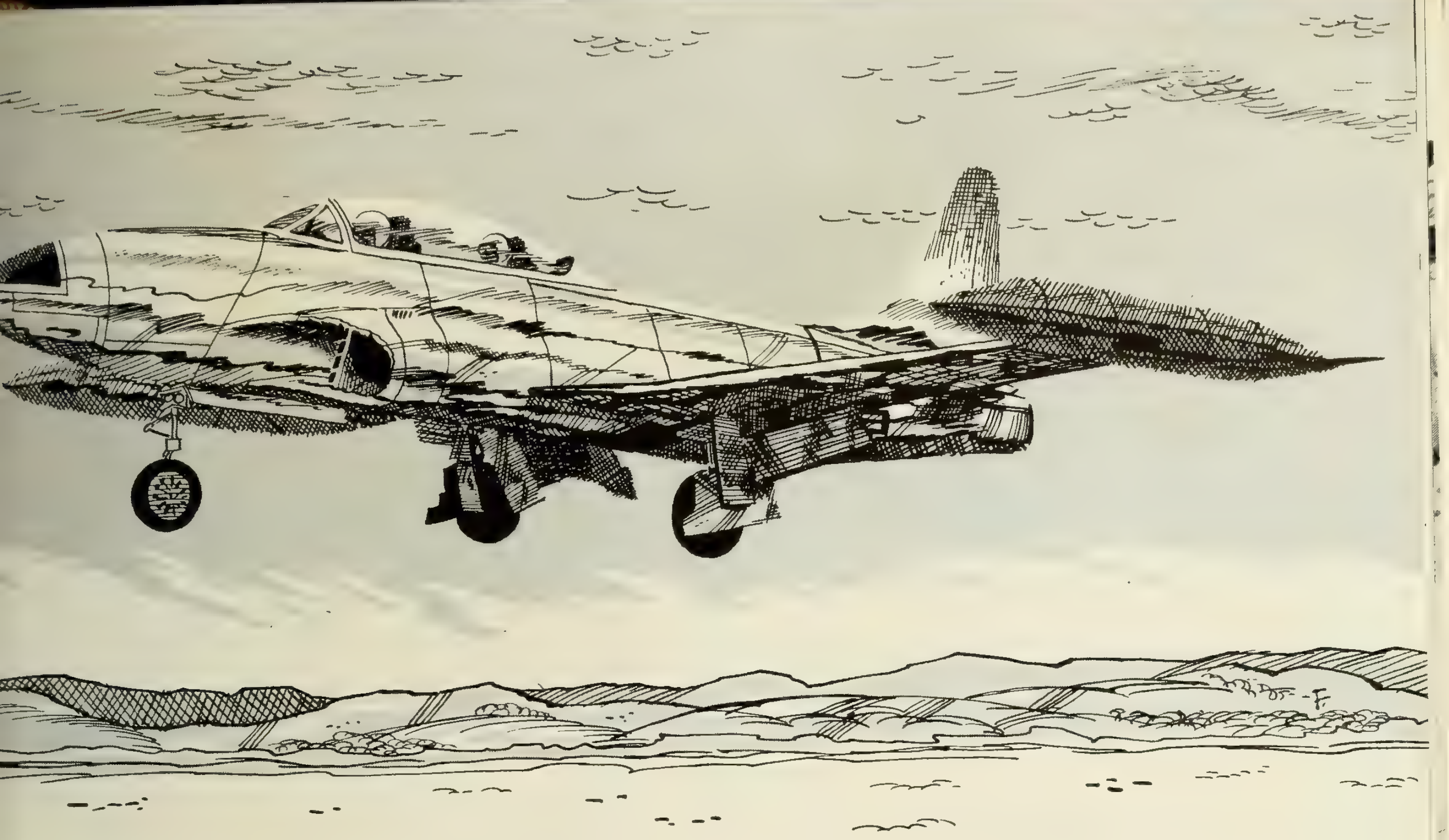
"How about trying with me?" invited Major Ham.

Captain Johnson reached across the table to pick up a pencil and pad.

"In computing the takeoff we're reminded that we're dealing with a rather warm day, at high altitude—88° and 6000 feet, to be precise. Since we'd taken off with a full load of fuel, there was no effort to figuring the landing weight. There was a shower over the runway when we started so there was no doubt about how wet it was." (Captain Johnson wrote each of these figures down as he said them.) "Oh yes, 8000 feet," he mumbled and jotted.

"The T. O. will show a landing distance of 4200 feet for the T-Bird at 15,000 lbs. and 6000 feet MSL. There is no firm advice available for wet runways, but down at USC they indicated that 50 per cent traction was pretty optimistic on wet blacktop. If you use that figure you come up with 8400 feet of rollout. Add to this the runway lost before touchdown and you'll have a picture that I don't want to appear in."

"Don't you think that a sharp pilot, using short field technique, could make it?"



"It's very possible, sir. I feel that a genuinely sharp pilot would pass up the try though, unless he was relieved of the risk for experimental purposes. He couldn't afford it."

This reply puzzled Major Ham. "What do you mean, Bill?"

"I mean that when a pilot really understands the physics behind a landing, he avoids accidents by keeping the performance limits working for him, not against him. I can't believe that Colonel Kelly would try a landing if his computed roll-out was 400 feet longer than the runway."

"Are you suggesting that the Colonel doesn't know how to plan for an overweight landing, Bill?"

Landing Roll

"Suppose I answer you by asking if you know the details behind a landing roll?

"Try me," he invited, feeling the confidence of his experience.

"All right," began Captain Johnson. "What does the average pilot have in his mind for a basis of landing estimates?"

"Well, I always have the normal distance at my home base as a start."

"Fine," answered Bill, "let's start at sea level. What did you have when you were flying out of Tyndall?"

"Well, a maximum, hard-brake stop would be about 3000 feet, I should say," answered Major Ham.

"All right, how much extra would you allow for a full fuel load, and, incidentally, why?"

"I'd make a liberal estimate of 4300 to 4500 feet, and what do you mean why?"

"Did you make your estimate by considering extra weight or, were you thinking extra speed?"

"The weight, of course. The speed has nothing to do with it. The performance chart in the Handbook doesn't even mention speed."

"What formula or rule do you use in your estimate, sir?" asked Captain Johnson.

"Double the basic figure and reduce it by 10 per cent for each year of experience, I suppose. Why? Is there actually a rule?"

"In a sense, yes. Your stopping distance is directly related to the touchdown speed." (Captain Johnson waved the Major back into his seat, then continued.) "To understand roll-out, you must break the function down to an average rate of decelera-

Captain Johnson started to jot down the figures to show how an overshoot could have happened.

tion, and analyze it from there. The factors that cause deceleration are aerodynamic drag and braking action. To avoid excessive detail, we'll regard the aero drag as a minor item and concentrate on brakes. Suffice to say, however, that in these days of fast landings in clean aircraft, drag devices are very important. Braking action will deliver a given proportion of stopping force for each pound of weight on the wheels. The exact amount is a consideration of the coefficient of traction. A coefficient of .4 would mean that a force equal to 40 per cent of the weight on the wheels would be delivered during the time of application.

"Stopping is a progressive reduction of speed. The initial speed is reduced by some number of feet per second, progressively. If you land at 100 knots and come to a stop in 20 seconds, you have decelerated at a rate of 8 feet/sec/sec. The definition of 1G is an acceleration of 32 feet sec/sec. Eight is one-fourth of 32, so you can see that a 20-second stop from 100 knots is a .25G deceleration. Average!"

Major Ham seemed to be with it to this point, so Bill continued.

"Now, more basic physics.

60 kts = 100 ′/sec.
100 kts = 166 ′/sec.

"If you touch down at 100 kts and apply your average deceleration, what do you see? You see that a speed of 166 ′/sec. was reduced to 158 ′/sec. during the first second of roll-out. The average speed during that second was 162 ′/sec. This means that 162 feet of runway was used to reduce the speed by 8 ′/sec. or 5 kts. Consider the last second of motion now. You enter at 8 ′/sec. and reach zero in one second. Your average for the time is 4, so you only used 4 feet to lose 5 kts. This makes the touchdown speed look pretty important, doesn't it?"

"Where does the weight come in?" asked Major Ham. "The Dash One says——"

Weight or Speed

Captain Johnson interrupted him with an apologetic wave, then began, "The old T. O. gave actual test flight figures. They published it in terms that our pilots were familiar with. It was a necessary move because the Air Force didn't have the time or means to educate us. Unfortunately, it still doesn't. The new T. O. gives a plot of the actual factors to be considered. You'll find that it shows IAS and then gives the factors which affect the TAS. These, of course, are temperature and altitude. Also, weight is conspicuous by its absence. There's a reason for this.

"You're familiar with the rule for extra speed for heavy approaches. It is not only the approach speed that goes up though, your touchdown and stall speeds rise by the same amount. The real reason for the speed adjustment is to provide you with the same attitude for every approach and touchdown. The increased speed allows the same old angle of attack to carry a heavier load. You remember, lift increases as the square of the speed. In familiar terms, 5 per cent more speed gives 10 per cent more lift. That's how the squared power works.

"Here's some more dope along the same lines:

- 5 per cent more speed requires 10 per cent more runway. Bear in mind, this extra speed works in that area where you use over 160 feet of runway to lose five knots.
- 5 per cent speed increase gives 10 per cent more lift, also. You can see by this that 10 per cent extra weight requires 10 per cent more runway."

"Now I've got it," offered Major Ham, "you just figure the weight in percentage and add that percentage of runway. That's easy enough."

TAS Effect

"Easy now, we haven't discussed TAS and wind, yet. First of all, the bird flies on IAS because this speed shows the dynamic pressures at the speed. This is a reflection of the weight of the air and that's what you fly on.

"In stopping you are dealing with the actual velocity along the ground. Consider our case today. I figured that we'd touch down at 115 indicated. At 6000 feet and 90°, the E-11 shows a true speed of 132 kts. That's a bunch of speed. You'll use about 220 feet of runway to lose your first 5 kts. of speed.

"The important point is that your touchdown speed is now 23 per cent over the light airplane at sea level. That means your roll-out is increased by over 65 per cent although your weight may only be up by a small percentage."

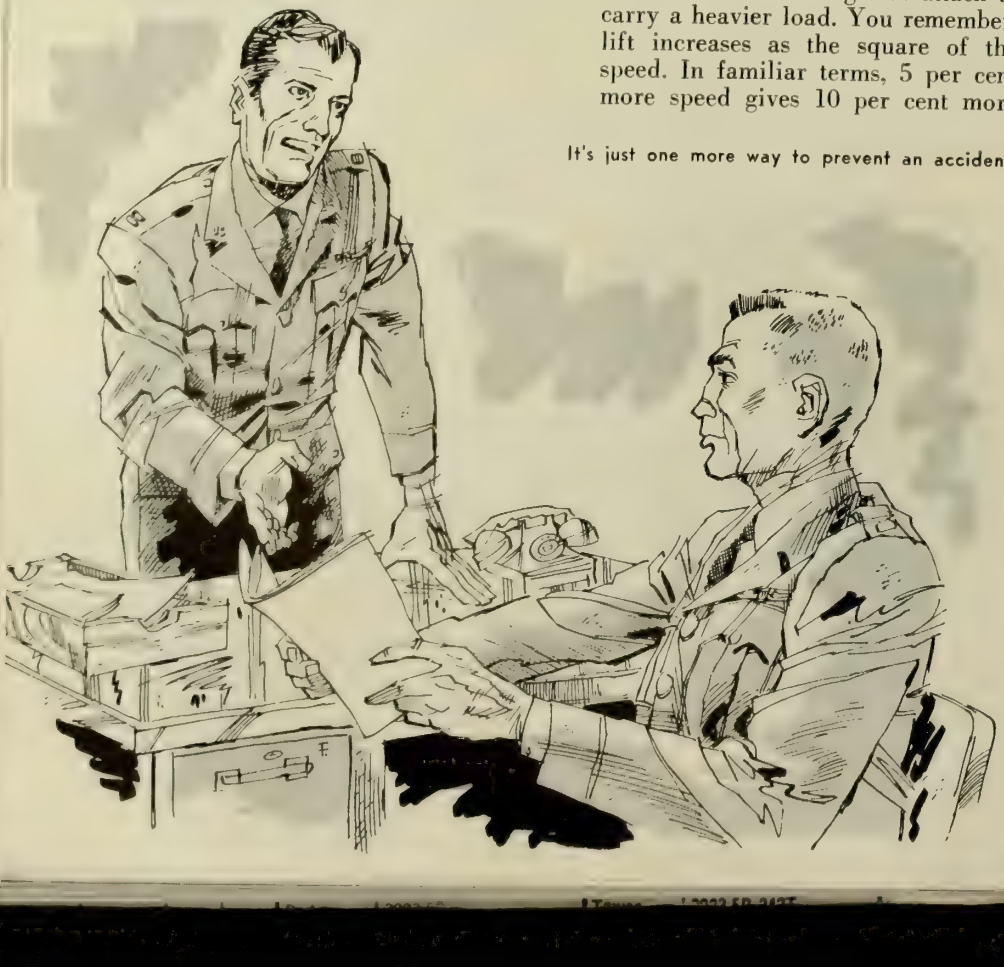
"Bless my soul," said Major Ham, "there's more to this than meets the eye. Let's see, if you adjust the speed to meet the weight, you then convert to true." . . .

"Add or subtract the wind," Captain Johnson picked up the sequence, "convert it to a percentage of basic landing speed, then apply twice that percentage to your landing distance."

"Let's see," Major Ham performed some mental gymnastics, then continued, "I figure that 5000 should do it for a fully loaded T-Bird here at Peterson today. Why did you say you refused to let the Colonel land?"

Bill Johnson didn't answer; he just glanced out the window. The current rainshower served to refresh Major Ham's memory. "Oh yes, I forgot to figure the traction factor."

"That's the whole point. You've got to figure all the angles." ▲



It's just one more way to prevent an accident.

FORMS

The Air Force has lots of forms and each one has its purpose. The purpose of one is to save aircraft and pilots. This form, known as the Operational and Hazard Report, has been taking a back seat of late.

Let's give each other a break by sharing our experiences. When you have a near-miss or come upon a hazardous condition, make out and submit an Operational Hazard Report. Incidentally, Rex Riley would appreciate receiving a copy too.

Mal is leader, flight of four,
All preflight briefing does ignore.

He fails to tell those on his wings,
Of mission type, and other things.

From 30,000 he screams down
Just wants a look at yonder town.

His faithful troops hang-in-there-tight,
And Mal ignores their perilous plight.

The price for this flight-leader's spree,
Three wingmen roost in yon elm tree.

*U. S. GOVERNMENT PRINTING OFFICE . . 402038

.1305
YS

BRUARY 1957

FLYING SAFETY

UNITED STATES AIR FORCE

the
NEW
PILOT

•

3P = 2P . . . . See Page 15

THE LIBRARY OF THE
FEB 25 1957
UNIVERSITY OF ILLINOIS

File Thirteen

This month our cover depicts the new pilot. And that is the theme of this issue of FLYING SAFETY. . . .

There have been some changes in AFR 60-22, the reg on ADIZ procedures. Formerly, any flight that originated in the eastern or western ADIZs had to be IFR or DVFR. Now such flights can be conducted without restriction if the flight path does not come closer to the adjacent defense area than the point of origin. Thus, if you take off from an ADIZ and do not proceed toward the defense area, you can file straight VFR. Also, you can penetrate or operate within a coastal ADIZ unrestricted when your flight path is always *away* from the land portion of the U. S. . . . Then there is the true account of Henry (Hank) Vendrig who was piloting an F-84F. His aircraft was second in a flight of two and was just airborne. Passing through 800 feet, indicating 250 kts, he received this transmission: "Hank, you're on fire. Get out!" So Hank reached down, pulled the trigger and got out. All neat as a bald head except for one thing. The message was actually sent to another pilot named "Hank" who was taxiing his aircraft when the compressor failed, resulting in a fire. It was sent by another pilot who was following the taxiing aircraft. Airborne Hank's comment: "Lucky there weren't more fellas named Hank flying around."

Perry J. Dahl

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Please send Flying Safety Magazine for one year to the following address. Enclosed is a check or Money Order for $2.50. ($3.50 for foreign mailing.)
Catalog No. D-301.44.

Name____________________

Address____________________

City____________State__________

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major Vernon R. Stutts

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby

Editorial Asst.
Amelia Askew

Distribution
T/Sgt. William H. Johnson

CONTENTS

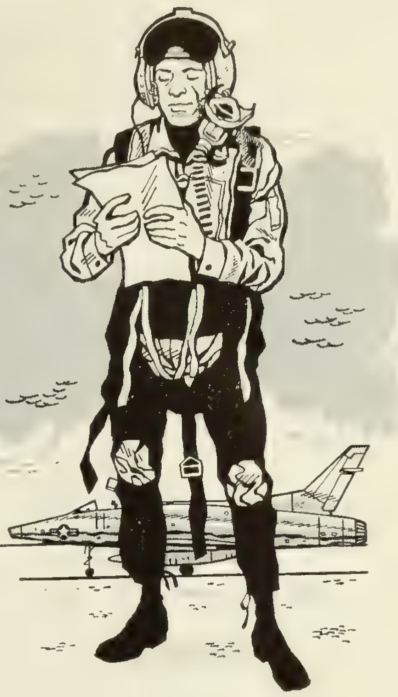
Letter to Newhead 1
The Big Picture 4
It Could Happen to You 6
Down and Locked? 10
Punctuate Your Position 12
The Ballad of Jethead Jones 14
The World of the Warrior 16
Rex Says 19
Dial Channel Thirteen 20
Keep Kurrent 23
Bailout 24
Crossfeed 27
Air Discipline 28

VOLUME THIRTEEN NUMBER TWO

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

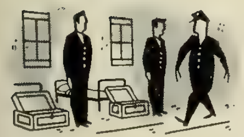
Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1



Dear Lieutenant Newhead:

You've just completed a year of flight training. Everything you did was planned for you--when to go to bed, get up, eat, squat, fly and drink. It was "Mr. do this," and "Mr. do that," until you thought a few times it might be necessary to pop a few guys in the snoot if you were going to keep your senses. It all ended somehow and now your training becomes a matter for your own effort. You'll probably be wondering how people could think you were so stupid one day, and then consider you a capable fighter pilot the next and give you loads of responsibility. Because of this, I'd like to take a few minutes of your time to say something about flying safety or flying safely or, better, how to live as long as possible.



Did you get an assignment to ADC? Get ready to spend lots of time waiting in the alert hangar and then every now and then be kicked off into the cold, black night with nothing for illumination except occasional flashes of lightning. There won't be anybody there to help you fly the beast. How true were the words of the RAF fighter pilot when he answered Mr. Churchill's question concerning the mental strains of flying. His reply was that it was nothing but hours and hours of boredom separated by short intervals of stark terror. Or maybe you're being assigned to SAC. You'll probably find yourself jockeying an '84F or a '101 on long, simulated special weapons drops, operating as a wingman in a flight of two, capable of carrying more destructive power than all the World War II bombers put together. We pray that it will never be necessary to drop those things but if it is, you'd better be ready. Perhaps you are being assigned to TAC. That's good fighter pilot duty with a variety of missions--special weapons delivery—air superiority missions—conventional bombing and strafing. Doing all of these jobs well, using the latest supersonic fighter, will require a lot of effort on your part, Newhead. However, because I've seen your counterparts operate in the past, both during training and operational, I know you can hack 'em all. But I would like to try to warn you of some dangers and ask you to profit by the experience of others.

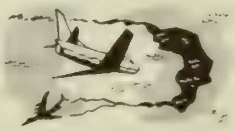
It doesn't matter much which of these assignments you get, one thing is sure in all of them. You, as an individual fighter pilot, will be required to accept more responsibility than your counterparts of preceding years. Interceptors, although operating in the same area, are operating as individual aircraft. SAC and TAC fighters carrying special weapons will have specific targets assigned to each element and you will have to be able to get there with or without a leader. Even on tactical air superiority missions, you and your element leader will be a primary fighting team. All of these things add up to the fact that you must accept more responsibility for the safety of yourself and equipment.

Now, wait a minute--don't leave me and flip to the inside back cover to study the aerodynamic features of the Editor's latest. I've been jockeying this flying safety desk for two and a half years now, and I'm worried. Do you realize that at the present rate it is possible for the fighter pilot race to completely destroy itself before the black boxes that will replace us are ready. Before I came to this job I would take offense at the statement that a fighter pilot was a bomber pilot with his brains knocked out. After seeing what some of our clan do, I'm not so sure. Sixty-eight per cent of all Air Force aircraft accidents involve fighters and 45 per cent of these are caused by pilot error. On top of that, most of the fighter jockeys who have the accidents have less than 500 flying hours and are under 25 years old. As I said before I have confidence in your ability to deliver the goods in wartime, but some of the goofy things that you do on the so-called routine training missions amaze me. Let me show you what I mean by listing some of the fighter accidents that were reported to D/FSR on an average morning. Remember, please, that this happens with regularity.

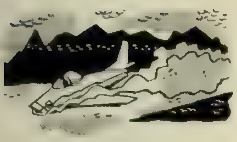
Here's one. Pilot advanced power for a go-around, retracted gear and cleared the runway. He experienced compressor stall and bellied the aircraft in alongside of the runway. Do you remember your instructor telling you to continue your final approach and not retract the gear until you were sure you were flying after starting a go-around? I think it is common sense to be sure your engine is developing full power before changing your plan to land.

Another pilot executed a closed traffic pattern after go-around and declared minimum fuel on the downwind leg. The aircraft stalled on final and crashed inverted. The mission should be mighty important for you to stretch it to the point where you can't make a go-around without getting down to minimum fuel. It was common during the Korean War to have pilots queuing up to enter the flameout pattern but they had good reason. Give me a good reason for this type of operation in present day flying.

This next type of accident happens regularly to fighter pilots. During a navigation flight the radio compass became unreliable. The pilot was lost and the aircraft ran out of fuel and he bellied it in. Most of us have found out that nearly every time you poke your nose into a cloud the radio compass is immediately unreliable, that's why we try to plan our flights to provide for an alternate course of action. Most other fighter pilots won't think you're an odd-ball if you keep a check on your groundspeed, position and fuel consumption. Son, I say get out there and fly that weather, but get ready before you leave the ground.



Something in a similar vein but more gross is this one. The aircraft was in the traffic pattern when another pilot declared an emergency. Following proper procedures, the pilot cleared the pattern. Then while waiting to land, he became lost.



The "bird dog" wasn't working just right and he couldn't find the landing patch so he ran out of fuel and bellied it in. You wouldn't think that could happen in an area where three major airfields are almost within gliding distance of each other, but it did. 'Splain that to me, Newk.

Or, how about this one? As the lead aircraft pulled off the target from a firing pass, the tow ship caught fire. The tip-tanks, canopy and other pieces were seen coming from the aircraft. The pilot ejected but was lost in the water. The only thing I can say about this is that someday you'll probably be a tow pilot and then you'll hope that all concerned are abiding by the Golden Rule.

The final listing is as old as the hills but it still happens. It goes: With the flight in trail the leader pulled up into the sun and No. 3 collided with No. 2. Axiom: Unless you have enough sense to get out of the area when you lose sight of other flight members, sooner or later you will hit somebody.

Now, there is one thing that all of these pilots had in common: None of them expected or wanted to have an accident. From observation, I have concluded that most fighter jockeys have accidents when they get caught by the three C's, the first of these being Confidence. Don't jump at me yet--I know that a pilot must have confidence and aggressiveness. What I really mean is overconfidence, but it spoils the alliterative effect to write it this other way. As you accumulate flying time your confidence will increase. That's good, except when it increases to the point where you neglect important parts of your individual flights. When this happens you have reached the second plateau. Complacency. This attitude is like having a perpetual jag on. You get intoxicated with your own flying ability and feel as if you can make that airplane do everything except talk, come high or low weather. You're almost there now, because the next logical attitude is Carelessness. A derivative of the old expression "I couldn't care less." After reading approximately 500 reports of accident investigation, I am convinced that the guys who have accidents in most cases just get careless and neglect minor, but important, details of their flights. Someone once said "save the pennies and the dollars will take care of themselves." We can paraphrase this to say 'take care of the minor details and your flight will be successful.' If I wasn't sure of this I would have to turn in my wings because my chances of being next would be too great. So, for the mathematically minded, the formula goes like this: Confidence (over) + Complacency + Carelessness = Accidents.

Well, Tiger, congratulations to you for completing your flight training. Now, take your time and don't try to learn everything about flying in the next year 'cause, honestly, you have just scratched the surface and we would like to have you with us for a while.

Edward P. McNeff

EDWARD P. McNEFF
Major, USAF
Fighter Branch, D/FSR

Last month, FLYING SAFETY outlined the structure and objectives of the Flying Safety Program for 1957. February is the month that brings the "New Pilot" into the picture. The following report has been extracted from a study made to see just where the pilot, with a limited amount of experience, fits into . . .

The Big Picture

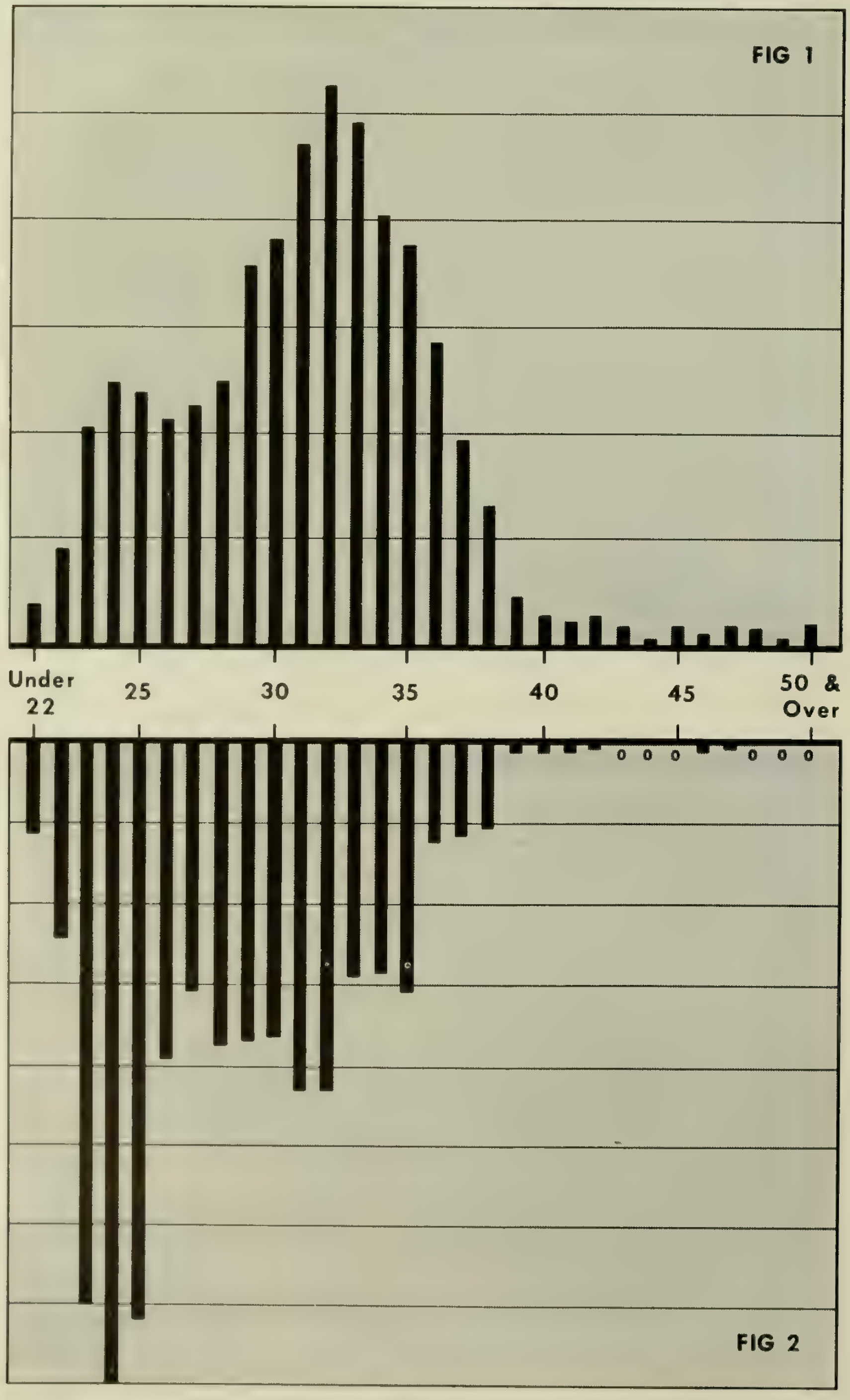


Figure I indicates the age distribution of USAF pilots. The average age is 31. Figure 2 shows the age distribution of pilots who experienced accidents: Average age, 28. Study the combination of both figures for a comparison of age versus aircraft accidents.

ONE OF MAN'S most apparent limitations is his inability to learn. There are vast differences in the time required by individuals to learn, but even with the most capable, learning is a time-consuming process. When the number of judgments, interpretations and procedures which the pilot must master are taken into consideration, it is not surprising that the time allotted for training must be of considerable length.

The pattern of jet fighter accidents related to jet flying experience during the past several years shows that almost half of all major jet fighter accidents are experienced by pilots with less than 150 jet hours. Approximately 60 per cent of these are charged to pilot error. (All references to flying hours are as a rated officer and exclude student time.)

Further consideration of the accidents experienced by pilots with limited flying time shows that accidents occurring during the second 50 hours of rated experience are considerably in excess of those happening during the first 50 hours. According to the standard concepts of learning, this is an abnormal situation. Ordinarily, in the learning of any task, the greater number of errors are experienced during the initial stages. Possibly this high accident rate for the second 50 flying hours can be explained since this is the period that includes tactical flying operations. Perhaps the pilot's previous experience has not prepared him for these assignments.

The records show that the greatest accident potential is in the early age groups. A graphic demonstration of the tremendous impact of accidents experienced by pilots under 25 years of age on the entire accident picture is shown in Figure 5. Although these pilots represented only 11 per cent of the total USAF pilot pool, they accounted for 30 per cent of all pilot error fatalities. Because of the large

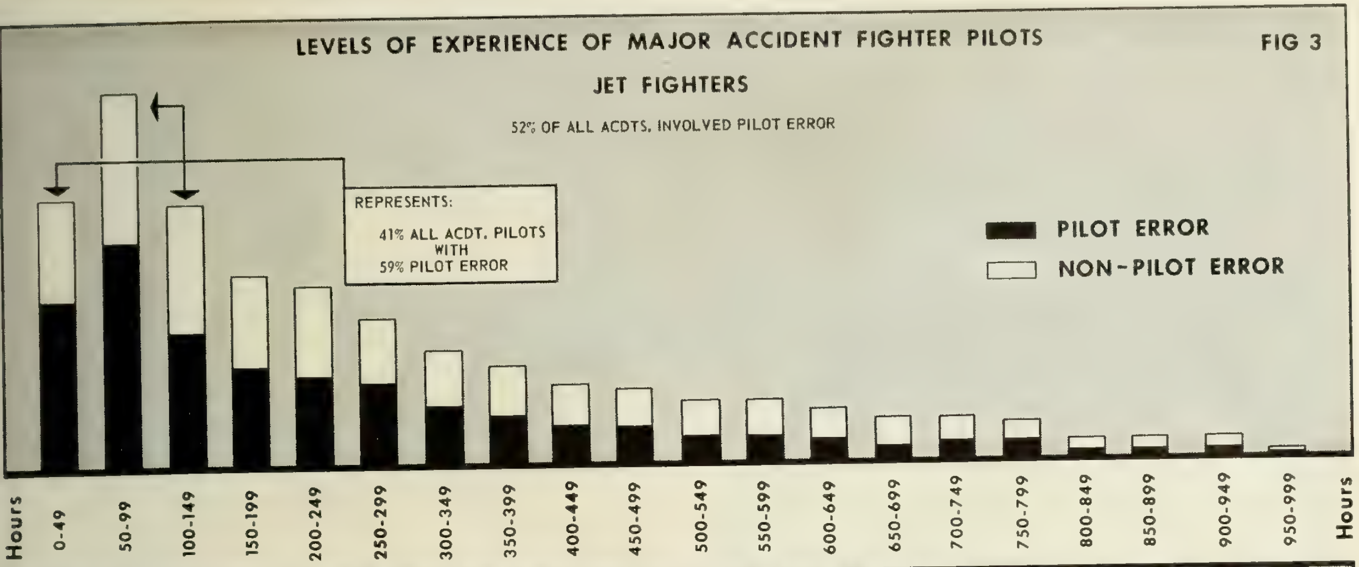


FIG 3

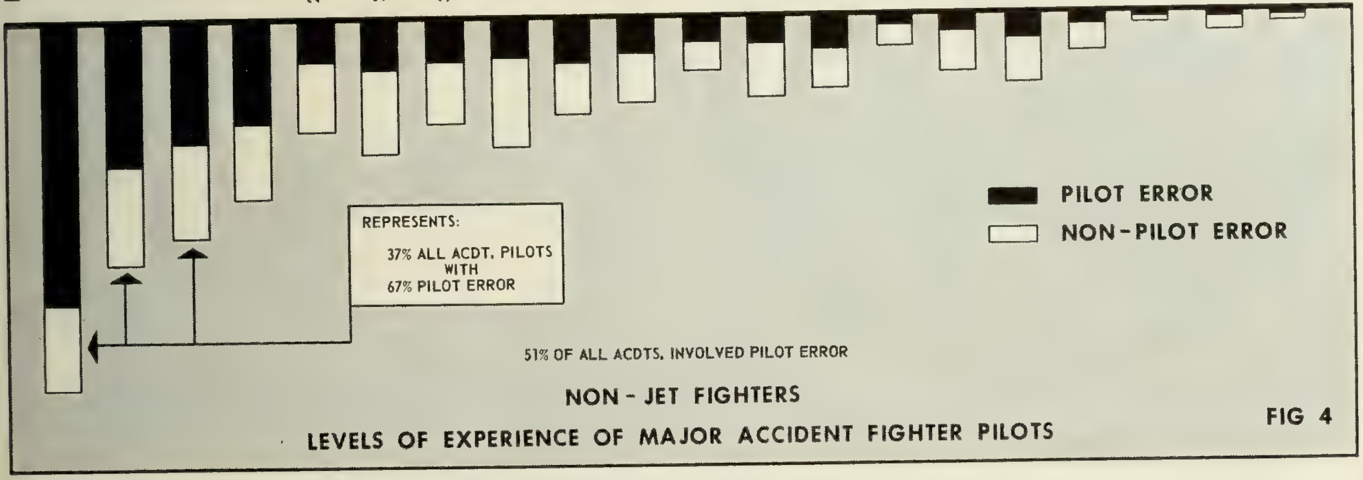


FIG 4

Fig. 5 shows impact of pilots under 25 years of age on the USAF aircraft accident record.

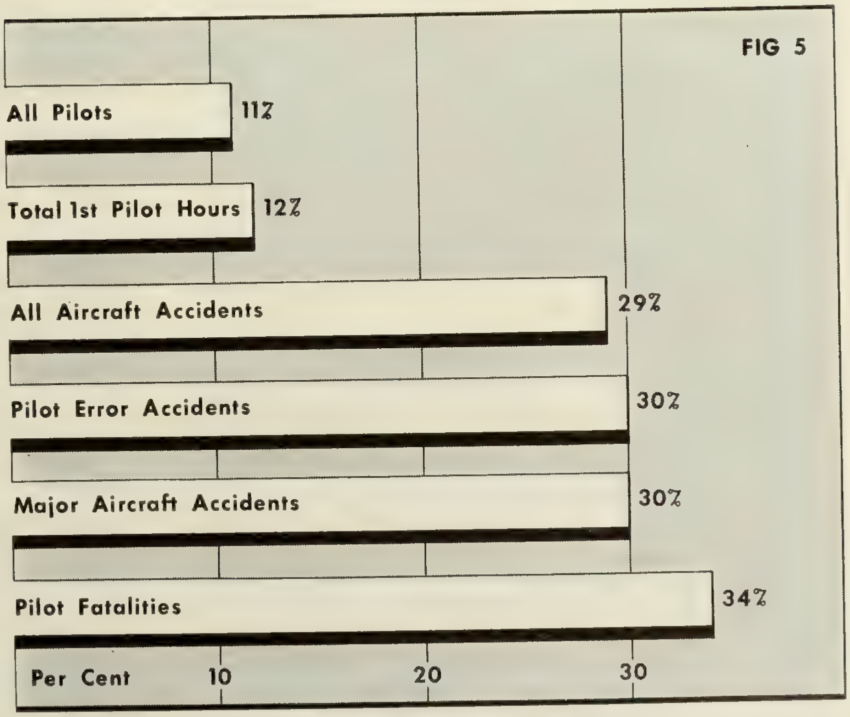


FIG 5

number of accidents experienced by these young pilots, it is in this area that the greatest gains can be made. Some gains can undoubtedly be realized by providing more adequate training. The recognition that training must be directed in every instance toward the pilot of lowest proficiency rather than toward the pilot of average or superior ability, is also a factor. This will impose restrictions on some of the more capable pilots but can be expected to result in a total gain by decreasing the accident potential of those pilots who are causing a great proportion of the accidents.

Finally, it should be recognized that during the early hours of operational flying, following training, careful supervision must be exercised. ▲

In keeping with the concept of "Learning from the errors of others," FLYING SAFETY requested reports of near-miss experiences from some of the old heads. Here are a few. Remember . . .

It Could Happen to YOU!

ONE night I was on a T-Bird flight with another pilot and on the second leg it was my turn to navigate. We were filed 1000 on top and had to go to 39,000 to clear an area of intense thunderstorms. We obtained station passage and gave a position report but I was having difficulty re-tuning the radio to the next station. To be able to see the radio dial, I doubled over until my eye was near the dial. I completed the tuning, then turned the volume up for identification. I spread my WAC Chart and began to figure an ETA.

The next thing I remember was the pilot in the front seat discussing his impending emergency landing while descending through 15,000 feet.

Later, I remembered re-connecting my oxygen hose, selecting 100 per cent, and calmly asking the pilot what the problem was. After a few minutes on 100 per cent oxygen, I was feeling fine and we landed. The flight surgeon met the plane and I spent the night in the hospital, under observation.

My oxygen hose had been connected and clipped to my shoulder harness. I had evidently caught the alligator clip on my parachute harness and when straightening up, disconnected the hose. Of course, the proper way to connect the oxygen hose is to wrap the strap on the mask hose around the parachute chest strap and catch the end of this little strap with the alligator clip. This will hold the connection together. The pilot stated that he had intentionally depressurized the cabin before takeoff. He did this because of losing a canopy several years ago and was afraid of decompression at high altitude.

After talking to the flight surgeon I was impressed with the fact that my life depended on the action by the pilot in the first few seconds after hypoxia occurred. He called me on the interphone just as I passed out and began an immediate descent. He declared an emergency and let down through the weather, continually telling me to check my oxygen. For this reason I connected the hose and went on 100 per cent before fully regaining consciousness.

We can't live without oxygen, so keep alert and watch that blinker! ●

WHILE a WB-29 Instructor Pilot back in 1950, I was guiding a student pilot in the performance of a series of power-on and power-off practice stalls. The student pilot had retarded the throttles and raised the nose of the aircraft to approach stalling speed. I noticed that the manifold pressures of the engines were uneven and busied myself with retarding all throttles sufficiently to obtain an even power on all engines. After all, the student was a newly recalled reservist and was rusty as the proverbial gate, and I didn't want the airplane to fall off on a wing when it stalled! As I pulled back No. 1 throttle, which had been several inches Hg higher than the others, the aircraft stalled. It not only stalled, it rolled sharply to the left beyond a vertical bank; the nose snapped down and suddenly we were headed 180 degrees from the initial heading.

My rusty reservist was trying to figure where he was, so I immediately assumed command and began a nervous recovery. We experienced a reversal of elevator control forces until a normal dive was established and a recovery completed. Luckily no damage was done, except that the engineer lost his brief case through the main entry hatch as he tried to bail out. The fault? Mine. The moral? Cockpit inattention is not only dangerous in intricate jet aircraft; it can be fatal in any airplane. ●

UPON reporting to a new station after 30 days leave and travel time, I found that it was necessary to get a field checkout in the T-33 before being permitted to fly the aircraft solo.

I reported to Ops, was briefed by an IP and filed a local clearance. We picked up our personal equipment and proceeded to the aircraft. After examining the Form 781, parts 2 and 3, and signing the exceptional release, I conducted (in my opinion) a thorough preflight.

Start, taxi and takeoff were normal, but I noticed that the airspeed indicator was very erratic and would not indicate over 120 knots. Further, I had no altimeter or rate of climb. At first I thought that I had neglected to remove the pitot cover; however, I distinctly remembered tying it to the entrance ladder by the cover's red streamer. I notified the tower of my difficulty and after burning fuel out of the tips, had another aircraft in the local area pace me in to a safe landing.

Postflight inspection revealed that a small piece of red tape covered each static port. It seems the crew chief had washed the aircraft prior to this flight and had placed the tape over the static ports to keep water out. The red tape blended in perfectly with a red decal on either side of the nose, and neither the IP, the crew chief nor I had noticed it during preflight.

Had instrument conditions prevailed, this story could have had a different ending, since making an instrument approach under conditions of no altimeter, airspeed, rate-of-climb would be tricky, to say the least. I believe that had I broken the glass in the rate-of-climb indicator and dumped the cabin pressure, I could have obtained an altimeter reading; however, I don't know how accurate it would have been. Needless to say, I do not overlook static ports on preflights anymore. ●

AFTER leaving my T-Bird parked at a transient base for several days I requested a thorough preflight inspection. This was accomplished by a qualified airman from transient maintenance.

During my walk-around inspection I commented to my passenger that a pilot can't be too careful when inspecting his aircraft at a strange base. The fuel level in tips and fuselage tanks was checked and the tank caps secured. All wing tank inspection plates were checked for security. All went well until takeoff. Just as the aircraft broke ground I noticed fuel streaming from all four internal wing tanks. It was obvious that the caps had been placed in the wells but not tightened and the covers fastened over them. Our first stop was one hour and 10 minutes away. With enough fuel in the tiptanks for one hour and 35 minutes, plus a full fuselage tank, I reasoned that we had no problem. Heavy local traffic and restricted visibility supported the decision to continue the flight. After 35 minutes of flying we were at 30,000 altitude, cleared 1000 on top and just about as far from a base as any point along our proposed route. At this time things began to happen pretty fast. The tips went dry, the wing tanks were empty and we changed our flight plan for the nearest Air Force base. The base was approximately 120 miles away and reported 4000 feet overcast, 5 miles in haze. Thanks to DF steers, our heading was direct to the field. We let down for a straight-in approach, breaking out 17 miles from the end of the runway with 35 gallons of fuel indicated on the gage. A few seconds later the fuselage tank gage began to show an increase to more than 70 gallons.

The tower was notified of the fortunate turn of events and as they acknowledged, the cockpit suddenly became very quiet. There isn't much noise after a fuel starvation flameout. We prepared to eject and continued the approach. We still don't know how close it would have been because the first runway sighted was a civilian field four miles short of our intended landing point. With gear and flaps down our only real problem was to fly a pattern to kill off excess speed and altitude and not overdo it on either point.

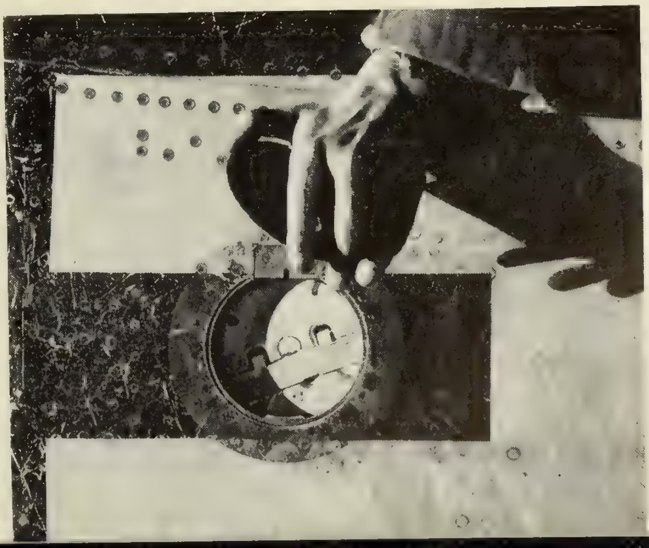
Luck was with us and with zero fuel load we only borrowed about 3000 feet of runway. Total flight time was 58 minutes.

In the first place I assumed that because the tank covers were secure, the caps must be properly installed.

Next, I elected to continue the flight with four tanks siphoning when the Book says "land as soon as possible."

Then, last but not least, I learned the hard way that siphoning wing tanks can drain the tips. As an added attraction, the fuselage tank has been known to collapse slowly, giving a false indication on the tank gage.

Even though we didn't know our position during the IFR descent, it was a comfort to know that approach control was aware of it. We had declared an emergency as soon as it was evident and therefore all available facilities were alerted. ●



THIS one involves the loss of engine power with full carburetor heat "On" during a night takeoff from Kirtland, some years back. This non-reportable incident would and should have been a "pilot error" accident. With so many contributing causes, the code sheet would have been filled.

The flight was scheduled as a night haul to Wright-Patterson. The aircraft was a B-25 and had a passenger load of seven personnel. Crew and passenger briefing, ground inspection, baggage loading and checklists were properly accomplished.

This particular B-25 had manually operated carburetor heat rise doors which were properly checked prior to engine start. During taxiing, the left engine was not idling properly and finally flamed out. Attempts to restart the engine were unsuccessful. The starter shaft was sheared.

The aircraft was towed to the maintenance area and exchanged for another B-25 which was "in commission." The usual confusion of off-loading and reorganizing the flight took place until finally the engines were started and we taxied to runway 26.

Now comes the boo-boo. This replacement (the second B-25) was a different model. It had hydraulically operated carburetor heat doors. The control handles had (and some still do) three positions: Forward (for cold), rear (for hot), and neutral. Now, where was neutral? Approximately 15 degrees forward of vertical. In calling for carburetor heat control check, the copilot merely "felt" for the controls and found them in a forward (15 degrees) position and responded "cold." Neither the copilot nor I actually *looked* at the heat doors near the cowl flaps to see if they were flush with the nacelle. All power checks will not, and did not, reveal the existence of the "oversight." Soooooo, down the runway we proceed. (I might add, it was right cold out that night.)

At approximately 3000-3500 feet down the runway, the nosewheel was lifted and I patiently awaited the "usual" smooth departure from the concrete. But, Lo and Behold, the aircraft merely skipped airborne and then fell back to the runway. My first impression was "pretty poor takeoff technique, Ol' Boy." It was not until the aircraft skipped the third time that the mental processes said, "Something is wrong." We checked the MAP and it was 38.5″, 2500 rpm. The airspeed indicator was correct, for 115 mph (IAS) was the maximum reading.

At this time of mental alertness, an accident appeared inevitable. At the far end of the runway is nothing but arroyos. On the last skip (end of runway) the aircraft was literally yanked from terra firma and the wheels were retracted. Fortunately, the landing lights were on, for they aided in maneuvering the aircraft down the arroyos and streets (downhill) until the airplane was finally not descending quite as rapidly as the terrain. At this time the pilot (Yours Truly) was completely mystified and instructed the copilot to alert all personnel for a river landing—in the Rio Grande. The terrain clearance now was in excess of 20 feet and a glance to the left engine was chanced. And what did I see? Lots of exhaust flame "diving" into the nacelle, right where the carburetor heat intakes are. The carb heat was full hot. Motions by the pilot to correct the conditions were, to say the least, instantaneous, at this recognition. Airspeed? It literally jumped from the 120 indicated to 160 mph.

Of course, the tower was calling, advising that we had descended too low over the City of Albuquerque. As if we had to be told.

Now, why did this happen? First, we had already worked nine hours during the day. Second, confusion and the associated mal-organization which resulted from the change in aircraft. Third, a poor visual inspection was performed on the second B-25. Fourth, neither the copilot nor I checked the actual functioning of the carburetor heat controls. Fifth, the carb doors were in the "hot" position in the first place merely because maintenance personnel were too lazy to place an intake scoop plug and streamer in the intake duct. (A check revealed that six other pilots had boo-booed in the same manner, but their errors were made in daylight and caught on the roll.) This same lazy procedure of closing the carb controls after engine shut-down to keep dirt out of the intake scoops is still being followed on some B-25s today.

PS: The Dash One Handbook stated that only 10 per cent power would be lost with full carburetor heat. . . . Right or wrong, this figure does not consider that detonation may cost you another 40 to 50 per cent when you use the heat improperly. ●

* * *

MANY, long years ago (back in 1946, to be exact), this h'yar pilot had more downright luck during one short flight than the normal man has a right to expect in a lifetime. By the Grace of God Almighty—as you will perceive shortly—and with the help of a fine tower operator, an accident was prevented not once, but twice, during the same flight. So, with that introduction, on with the story.

The location: That postwar paradise of the Pacific, Okinawa. The mission: An initial checkout in that most venerable of aircraft, the old T-6D.

Oddly enough I had somehow missed an association with that paragon of wings. In fact, my only previous Air Force experience with one engine and no company was in the Stearman PT-17. And who doesn't have a tale involving those two wings with the narrow landing gear?

Well, I reported down to Kadena Ops that morning with eager anticipation of flying the bird. There was no delay in starting the ground checkout. There was no delay in finishing the ground checkout. Come to think of it, there really *wasn't* any ground checkout. Oh yes, I did find out how to start the P&W while furiously working something they called a wobble pump.

Then off into the oriental blue for the flight checkout. Let me see. The flight checkout consisted of three flights around the pattern with two touch-and-go and one full-stop landing. All were wheel landings with no flaps. Seems there had been a rash of groundloops, and this procedure was instigated to preclude such unhappy events. Incidentally, it worked pretty well, as I recall.

Well, the landings were pretty smooth if I do say so myself. But somewhat to my surprise, after the full stop, the Instructor Pilot climbed out and yelled into my ears, "Okay, it's all yours. Think you can handle it?" My unhesitating reply was a confident "Roger," with an affirmative shake of the head.

It was mine, all mine! The checkout had lasted 15 or 20 minutes at the most. There was no questionnaire involved, and the Dash One, T. O. Handbook? What was that? But I could fly it; I could land it and it was mine!

So, away we went, just Thee and Me! Exhilaration was flooding the cockpit. I was sitting on top of the world.

I climbed, I zoomed, I flew straight and level. I also took the short Okinawan tour—Naha, Awase, Ishikawa (ah, Ishikawa). I couldn't have felt better or enjoyed life more if I'd been a charter member in the Teahouse of the August Moon Club. (Since I didn't know Glenn Ford or Marlon Brando, that was out of the question.)

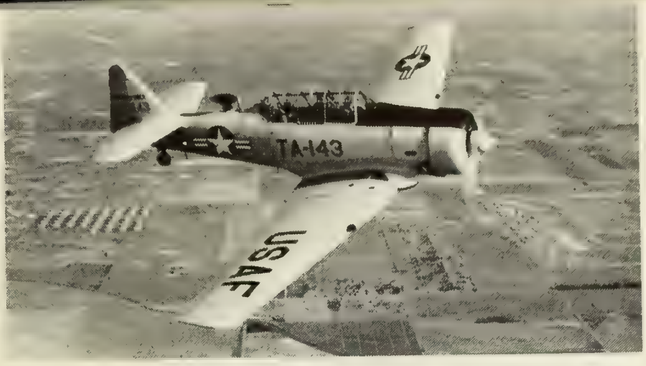
But the time came, as it must to all airmen, to land. My 45 minutes of pleasure were drawing to a close. Although there had been no "hours and hours of boredom," my reverie was nigh on to being punctuated by "moments of stark terror."

The pattern entry was fine, the wind was down the runway, the gear was extended and checked, and the downwind had progressed right favorably, albeit a little wide and long.

Suddenly, just before the turn to base, there descended on all of this peace and calm the rather terrifying noise of a sputtering engine. It was amazing how quickly that cockpit and I became unfamiliar—total strangers, in fact. What was wrong? It was hard even to locate the engine instruments. Finally, when I did, they seemed okay. The mixture was full rich, the prop was forward, and my meager altitude was rapidly going by the board. Dead-stick it into the field? Too far out. Crash land? Where? The rough Okinawan terrain was totally unsuitable and the East China Sea was uninviting. The beach? Well, it wasn't inviting either, but that's all there was. And the geography was such that a landing on the beach would be with a brisk tailwind. By this time, actually probably only several seconds, my stomach was in knots, my throat was dry and I was scared—real scared. Of course, during the turn toward the beach I was, with pounding pulse, still searching for the source of trouble.

By some strange stroke of good fortune my left hand shot down to the fuel control switch. I'd only been up about 40 minutes and surely couldn't be out of gas, but anything—try anything in a pinch!

Oh, what sweet relief! With one small switch of that control, the engine caught and "Thee and Me" were back in business. I was overwhelmed with feelings of relief. No accident for this boy, no published embarrassment and no injuries. Everything was going to be all right!



Yep, you've put your finger on it. I ran the left fuel tank dry, above the little standpipe that was actually designed to help keep you from running out of gas.

So, with lightened heart and profound thanks, I turned onto the now-long final and started on it. I kept saying to myself, what luck, what wonderful luck!

With a voice as normal as I could muster, the tower was notified that I was on a long, final approach with wheels down and locked. So—on down the final I went, pleased as a clam at high tide that the day was saved. When—"816, your wheels are not down, your wheels are not down!"

Gad! How stupid can you get? I must have retracted the gear automatically during the emergency, a reflex action resulting from ingrained, previous training. My thoughts had been so consumed with the luck I'd had and gratefulness for an accident avoided that I had just plain forgotten to put the gear down again. Cripes, how could anyone do such a thing, particularly me? I was mad at myself and in conventional terms, "well shook."

Although there was still time to get the wheels down and land, I pulled up, took a little time to collect myself and made a thorough check of everything (to the extent of my meager knowledge) before coming in again. And the landing was finally okay.

That tower operator, bless his soul, was really on the ball. I couldn't face him that day, but needless to say, later on I paid him all sorts of flowery compliments. Certainly he saved the government an expensive accident and saved me much trouble and public loss of ego.

Obviously, these difficulties were precipitated by several errors and by several people. I've often wondered, had an accident occurred, what would the board have concluded regarding the cause or causes? My errors and those of others were certainly not erased simply because I was lucky in the cockpit and the tower operator was sharp. We were morally as guilty then as we could ever be—accident or not.

Of course, the errors are plain. I should have known about that reserve standpipe arrangement in the left fuel tank and a lot of other things about the ship I didn't know. I should have asked for a more thorough checkout. I should have read and studied the Handbook, and I should have put the wheels down. However, my emergencies could also have been prevented by a properly supervised training and checkout program.

Fortunately, the days of quick-and-dirty, round-the-field checkouts are pretty well over and done with. And pilots, either through training and/or experience, are not the fools that I was.

Experience has proved time and again that shortcuts during checkouts are much too expensive, regardless of who the culprit is. For, in spite of the number of times the Good Lord has been in our corner, he is, after all, a busy man. ▲

DOWN

Since the first concept of retractable gear, the big question has been: Where are they?

Major William H. Hornbarger, Jr., D/FSR.

"Bully Red One, base leg, gear down, pressure up."

"Roger, Bully Red One, recheck gear, clear to land."

THIS TRANSCRIPT was taken from a recording between a pilot and a tower operator. It was made just prior to Bully Red One's gear-up landing. The investigation which followed revealed no mechanical malfunction of the landing gear or warning system.

Having spent over six years in the Air Training Command, I have had my share of runway control. During that time I "saved" more than one iron bird from alighting with his landing gear tucked up under his wings. Many times it seemed as though nothing short of a hundred and five millimeters across the bow would alter the glide path of the earthbound gear-up aircraft. However, if the red flares held out and you were able to reload without dropping the mike, the gearless birdman usually saw the light or at least one of the flares.

Although it is agreed that the use of mobile runway control during training flights is effective in preventing gear-up landings, it is an intangible criterion and cannot be applied in all instances. There are many cases on record of mobile control's getting through to the pilot on final approach with gear up, even though the cockpit indications (unsafe indicators, red light and horn) failed to make an impression. For example, Air Defense Command, in its round-the-clock operation, accomplishes many landings during periods of darkness and bad weather and therefore can not use mobile control to the same effective degree as does Air Training Command for example.

Not too long ago the F-86D gear unsafe warning light was relocated, placing it on the instrument panel as near eye level as possible. The idea was to make it next to impossible for the pilot to fail to notice an unsafe indication on final. In spite of the modification, however, F-86D aircraft lead the field in inadvertent gear-up landings. The basic solution to the problem appears not to be a simple modification of the gear warning or actuating system but rather a complete redesign or concept.

Since January, 1954, there have been 82 gear-up landings in jet fighter and T-33 type aircraft which were attributed to failure by the pilot to actuate the landing gear control. Thirty-two of these gear-up landings occurred during the calendar year 1954, and the F-86D was involved in 17, or 56 per cent, of the total. Only 23 such accidents occurred in 1955, and the 86 Dawg was involved in nine, or 41 per cent, of them. In 1956, the F-86D was involved in 17 out of the 27 such landings for a share of 63 per cent. The Dawg is accountable for 53 per cent of the total gear-up landings, yet flies only about 13 per cent of the hours and accomplishes a like percentage of the total landings. These figures include only pilot error accidents in which he failed to actuate the landing gear control. Gear extension failures or gear retractions after touchdown which resulted from malfunction of the landing gear system are not included.

Why is the F-86D outstanding when it comes to gear-up landings? Its landing gear system is similar to the A, E, F and H, and the gear position control handle is in approximately the same location. The position indicator and warning system are basically the same as those in other jet aircraft. There are many similarities but only one big difference: The F-86D is our only operational single-place interceptor. (We're sweating out the F-102A for this reason.)

The frequency of gear-up landings in two-place interceptors (F-89 and F-94) is far less than in the F-86D. The frequency of gear-up landings in F-86A, E, F, and H aircraft also is far less than in the D, although in many respects the aircraft are similar. Augmentation of radar and electronic equipment increases the complexity of the single-place interceptor cockpit considerably. This situation is alleviated somewhat by the radar observer in two-place interceptors. Stand-by alert and night and weather intercept missions are highly contributory to pilot fatigue.

In practically all accidents in which the pilot failed to extend the landing gear, an acknowledgment was made by the pilot in the traffic pattern to the effect that his gear was down and locked. Several accidents occurred during landings from a GCA and others after having had normal landing sequence interrupted.

To sum it up, the pilot task is becoming increasingly greater, and very little has been accomplished to aid the single-place fighter pilot in assuring that his gear is down on landing.

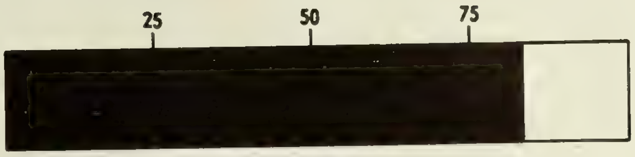
Recently we kicked around the idea to incorporate some sort of unsafe gear warning system in with the Identification, Friend or Foe (IFF). This idea was passed on to Convair who is very sympathetic to the gear-up land-

and LOCKED?

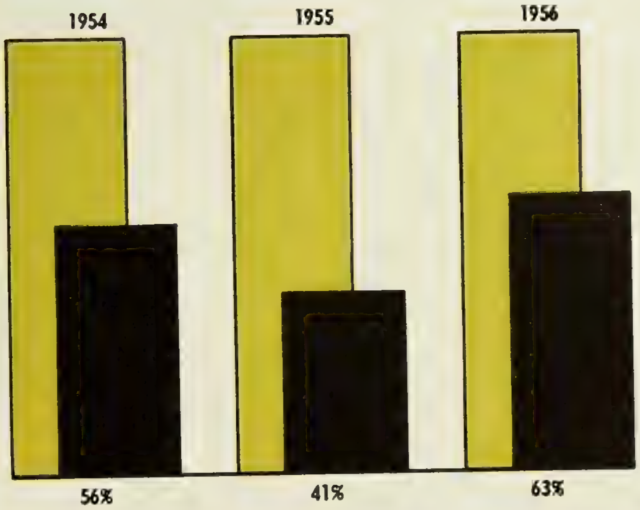
ing history (naturally since they have the F-102 going for them). Such a system might trigger a responder when gear is retracted. This signal would be received along the runway final approach path and would indicate on an interrogator in the control tower that aircraft on final had safe or unsafe gear. This system would even be effective in a four-ship flight on GCA if any one of the aircraft did not have gear extended.

As proven in the past, pilots are very much prone to agree automatically with the request to "recheck gear down and locked." A direct command over the radio for the pilot to "take it around, your gear is not down" is far more effective than an unsafe indication in the cockpit. Convair has requested an Engineering Change Proposal (ECP) for funds to develop and test this system.

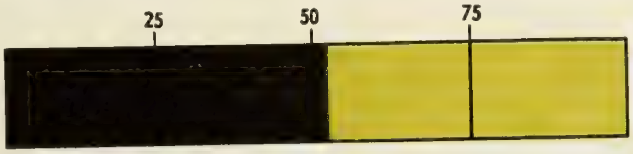
The British came up with another idea. Tie the gear-up warning in with the airspeed indicator. For instance, the average approach speed for a particular fighter is 160 knots. When the gear is retracted, a red flag or appropriate shield would cover the portion of the airspeed indicator between 150 and 170. This system is based on the belief that even fighter pilots check their airspeed at least once on final, and I believe this is a safe enough assumption. So when the pilot is unable to see the airspeed calibrations during approach, he merely extends the gear. Personally, I'll buy it. At least, we're going in the right direction. What do you think? We've got the problem—maybe you have the answer. ▲



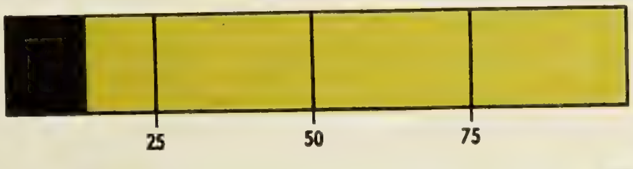
82 gear-up landing accidents occurred during 1954-56.

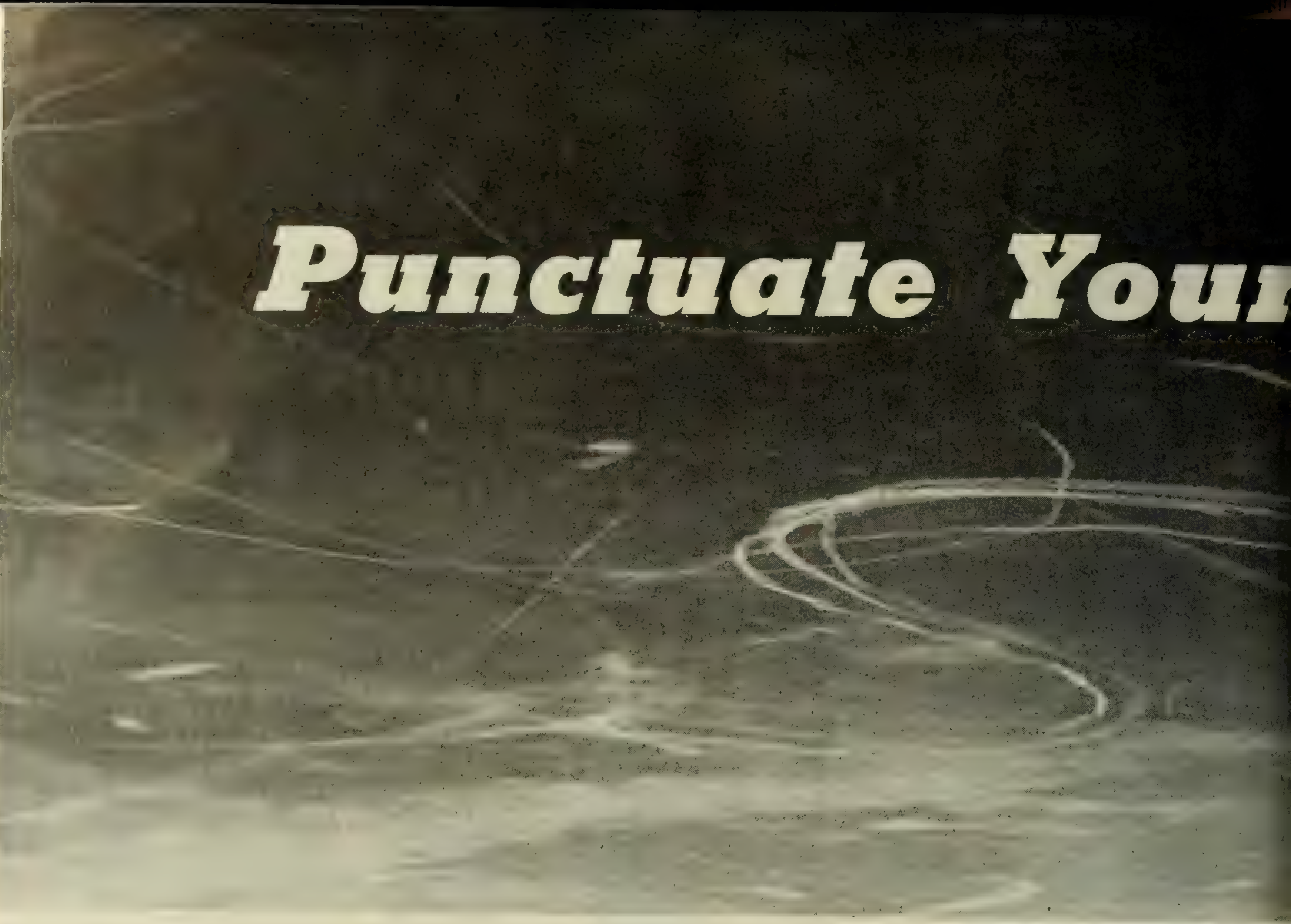


Study reveals that the F-86D was involved in majority of these



Compare landings, flying time below vs. gear-up accidents above.





Punctuate Your

Maj. David F. McCallister, 142d FIS, Delaware ANG, New Castle County Airport, Del.

Had any close ones lately? The higher and faster you and the rest of us go, the greater are our chances of piling up in a gory mess in the sky. Lots of people are giving the problems serious thought. Presented here is the same ol' problem with a couple of suggested solutions. They may have their drawbacks. There's no corner on the idea market. How about yours?

●

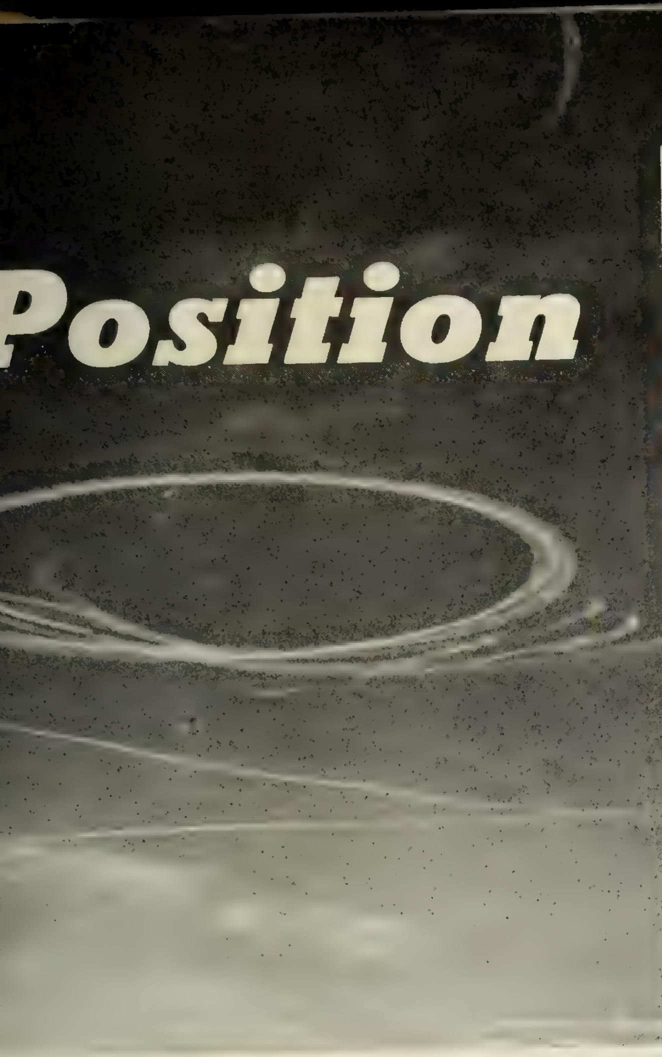
IF A JOCKEY hasn't had the nerve-shattering experience of suddenly looking up from his instruments to find his windscreen filled with an oncoming, six-engine lead sled (that appears to be approaching at something approximating twice the speed of light), then he can didactically state, "Bub, get your head out from where it's warm and dark and keep your eye on the skyroad." If he can state the latter in all honesty the chances are he hasn't spent much time above 30,000 lately, because, brother in blue, it's crowded up there!

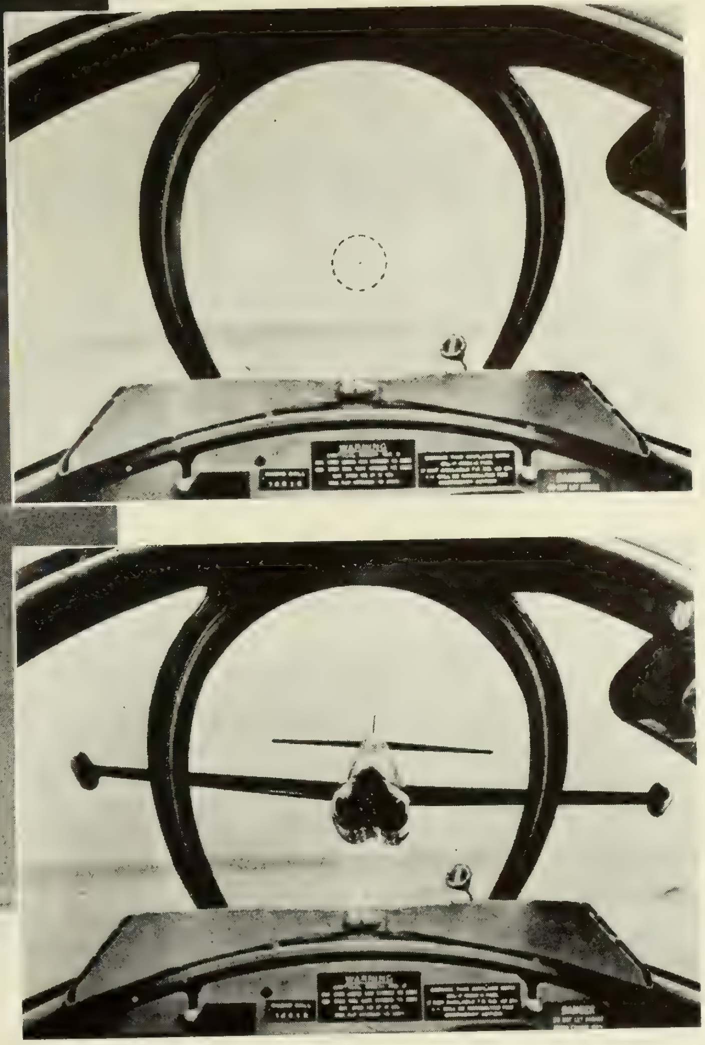
Although constant vigilance and sky scanning outwardly appear to be the solution to the midair collision problem at high altitudes, there are a few other things that must be considered before the fickle finger is pointed at the inadequacies of us who are determined to cheat the Grim Reaper out of his unjust dues.

It is generally accepted that a fair pair of 20/20s can detect an approaching aircraft at a range of approximately seven miles. When two jet fighters approach each other at a closing speed of 840 knots, at 14 miles, they are one minute apart. And not until the jockeys are thirty seconds apart can they visually detect each other. Presuming both are traveling at the same altitude, which occurs every day, there is a chance that they might make a perfect interception and add another chapter to that voluminous true life drama entitled, "Just One Durned Form Fourteen After Another."

Flying through weather, in controlled areas, is infinitely safer than flying through clear air in the same controlled area. As an example, on Green 4 airway, between Columbus and Pittsburgh, when the upper air is solid cirrostratus, all traffic is flying at assigned altitudes. It sez here. On a clear day on the same stretch of airway, a jet flying west on an IFR flight plan at an assigned altitude of 31,000 feet can very easily lock pitot tubes with another jet flying east at 31,000 feet. Both pilots are legal but the marble orchards are filled with dead right jockeys who are now legally dead. The solution to this problem is to refrain from requesting an assigned altitude when flying west unless weather conditions dictate otherwise.

Position





Right, flyspeck or airplane? You have only seconds to make your decision, complete your action to "avoid."

Flying a jet fighter or jet trainer in clear air above 35,000 feet requires a pilot to fly half contact and half instruments because of the inherent longitudinal instability of his aircraft. This is specially true in the early stages of a flight when the aircraft is still heavily loaded with fuel. Some aircraft, such as the F-86E, are extremely critical in this respect. Unless flown very smoothly it will lose, at its best cruising power, its cruising Mach of .81 or .82. Once the Mach drops back to .77 or .78, it requires more power or less weight to get the aircraft back "on the step."

In view of this idiosyncrasy the pilot must spend considerable time monitoring his altimeter so that he can be guaranteed the best Mach per gallon. And although the solution may appear to be in flying the aircraft at a lower Mach, it is fallacious because as the Mach is decreased the unstable condition is increased, requiring even more attention to instrument flying by the pilot.

Aircraft instability at high altitude is something with which we must live for some time to come. But a partial solution to the overall problem of giving the pilot more time to scan the skies lays in teaching him to fly smoothly, and at the Mach of least instability.

Even if aircraft instability were ruled out as a problem, we are still left with only a 30-second margin in which a pilot must see and avoid another oncoming aircraft. With some of our jet aircraft, we could increase this slim 30-second margin to a matter of minutes by installation of a sky marker device. Many of our jet fighters and bombers are equipped with water injection tanks that are seldom used. Through the addition of a timing device and a line running back to the aft end of a jet's tailpipe the seldom used water injection tank could serve a useful purpose on every flight. A one-second burst of marker fluid injected into the tailpipe of a jet flying at 420 knots would produce an exclamation point 616 feet long. This marking system has been used successfully to locate target towing aircraft on gunnery ranges and there is no reason why it cannot be used to promote flying safety in the "deadly thirties."

Mother Nature herself promotes flying safety by providing us with the elements needed for the manufacture of contrails. Pilots should take advantage of the contrail layer to punctuate their positions in the sky. Contrails can be seen from a distance of 100 miles under ideal conditions, and although flying in the contrail layer works against the combat tactical advantage of surprise, in a peacetime sky flying out of the contrail layer accentuates the age-old fighter pilot's byword . . . it's the one you *don't* see that will get you! ▲

the Ballad of
Jethead Jones

A Narrative by
George M. Goldberg, ACIC

The day was clear as he grabbed his gear
And Jethead's hopes were high.
He'd stayed up late with an all-night date
But couldn't wait to fly!

•

His hunch was right and a routine flight
Was scheduled on the board.
He made two stops, at Weather and Ops
Where Aero Charts are stored.

•

They forecast rough with a front and stuff
That made it IFR.
You fly it brave on a radio wave
To know just where you are.

•

"Best take a WAC," comments Airman Mac,
"I'll get you one for free!
"And here's a change in the radio range
"I got from the RFC."

•

But Jethead smiled as he casually filed
His flight plan for the trip.
He waved aside with disdainful pride
The Airman's worthy tip.

•

"To fly through soup, who can use such poop?
"Just let me have the book!"
So Jethead's fate, at an increased rate
Was sealed with what he took.

He watched the crew 'til its task was through
Then checked the jet himself.
Old Jethead Jones never shook his bones
Except to guard his health.

•

At ten past two, with his heading true
His ETAs checked fine.
But then the crest of a front due west
Grew black and formed a line.

•

He hit the squall like a rubber ball
The clouds were scalded steam.
But Jethead grinned as he tuned her in
And flew right on the beam.

•

His quick relief soon turned to grief
His headset buzzed and died.
His throat grew dry as alone in the sky
A fear grew taut inside.

•

He throttled back as he reached for a WAC
And nosed her towards the ground.
But with a start he recalled the chart
He'd scorned to have around.

•

His fuel was low, as he dipped below
His pre-planned altitude.
And soon broke through for a pleasant view
Which helped to change his mood.

•

Right up ahead was a valley bed
With hills to left and right.
But clouds came down as he spotted a town
And shut the land from sight.

•

In flying blind he couldn't find
A way to save his neck.
Nor did he learn that a valley can turn
Without a chart to check.

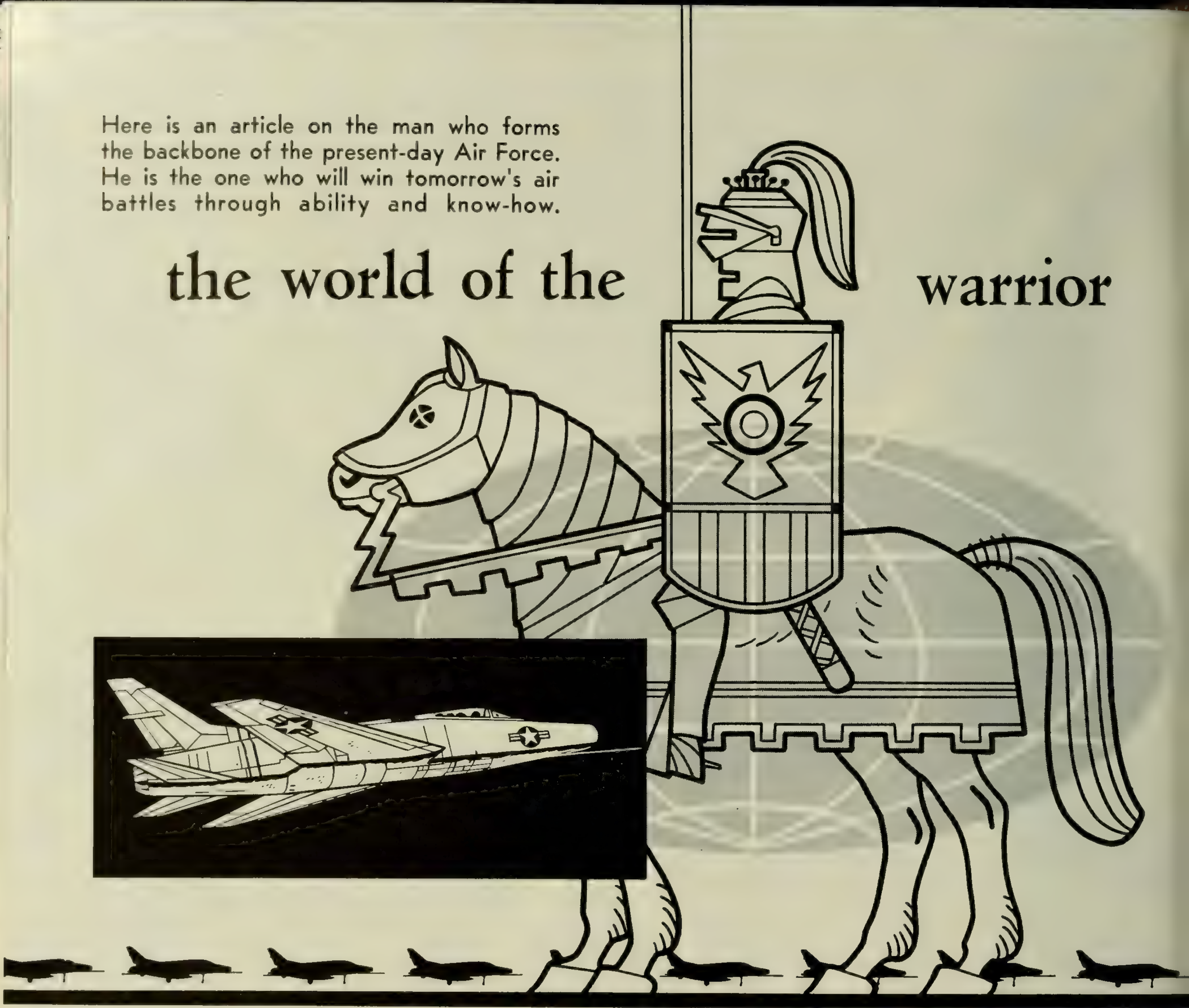
EPILOGUE

Old Jethead Jones, may they bless his bones
Had guts and steadfast heart.
No lack of skill made him hit that hill
But lack of a proper chart!

Planning · Procedure · Pilot Techniques
=
Professional Pilots

Here is an article on the man who forms the backbone of the present-day Air Force. He is the one who will win tomorrow's air battles through ability and know-how.

the world of the warrior



Colonel Russell V. Ritchey, Office of the Deputy Inspector General, USAF

AT ONE TIME in world history the fate of nations hinged upon the outcome of battles between their selected representatives. The cost of training, arming and equipping was so expensive that the common man, not able to provide for himself, could only await the outcome and abide by the decisions. The time, the middle ages. The representatives, the armored knights. These things combined to create this armed corps: A high degree of selection, rigid training and an inviolable code of conduct.

Today, the common man, the statesman, the merchant and the moneylender must again place their lives, homes and future in the hands of a corps of young warriors. Having done so they must stand helplessly aside awaiting the decision, once the battle is joined.

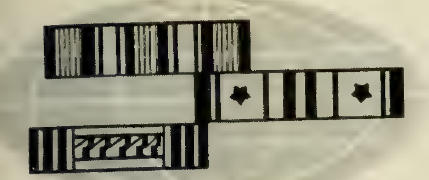
Once again, selection, training and equipment are the primary factors. The citizen finds the equipment and training beyond his financial capability to maintain. Today's warrior? Today's knight?—The pilot officer.

Even today the rigid requirements for the development of the air warrior are not fully recognized. Men introducing a new era are at the same time a part of the past era. As a result, their thinking must represent a part of both eras. For this reason it has been difficult for military men to give up the theory of mass. Quantity rules over quality. We sacrifice perfection for numbers. Men are selected on the basis of capability rather than the will to use the capabilities.

Perhaps at no time in our history has attitude assumed such tremendous importance. It has reached the point that attitude becomes more important than aptitude. Will over skill.

The pilot officer—the man upon whom the free world must rely, the man who, alone in the air, thousands of miles from home, confronted by every kind of opposition the enemy can contrive—must drive home the attack if this nation is to survive.

Is he something special? Yes, he is. He is if he has been carefully selected. He is if he has been carefully trained. He is if he has been carefully led. He is, if he possesses the will!

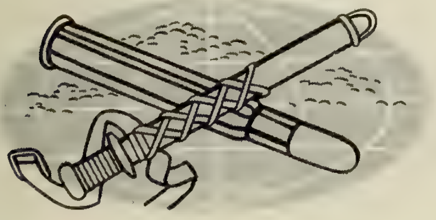


Let's look at the selection of this fighting man—the pilot officer of the nuclear age. First, for the identification of this very important man there is the weeding out of those who just like to fly; second, those who "just like the military life," and, third, those who "don't intend to get into any fight." Next, we must identify those who are in the service for an education, to serve their obligated service or to prepare for a job in civil life.

For those who are left there should be the moment of truth. Each must be dealt with frankly and honestly. He must be told that he will be flying combat aircraft, that he will carry the key to survival of this nation and the free world with him. That he will carry more power for war or peace than any other one man in the history of the world. That he may be shot down in hostile country, that, if he is captured, he may be made to suffer for his principles and for his country. That he may be wounded or killed in carrying out his duties.

He should understand that these things are the fundamentals of the profession to which he aspires. He should understand that education, housing, recreational facilities, retirement and dependents care are benefits accruing from honorable service but not an end in themselves.

He should clearly understand that when he accepts these conditions he is applying for training which will lead to the rating of combat pilot. He should thoroughly understand that he must be a pilot before he can be a leader. He must understand that the demands of self-discipline must be met before he can lead. That in this service the combat pilot must survive to lead and to survive requires rigid discipline, attention to duty, great responsibility, judgment, courage and stamina.



Perhaps in the past we have dealt too much on the $40,000 pilot and the $6,000,000 airplane carrying a $5,000,000 bomb destined to destroy $500,000,000 cities.

The values with which we are dealing in talking to this potential pilot officer linger after all other things cease to have monetary value. The man who panics or lacks the will, can abandon a multi-million dollar aircraft just as quickly as he can abandon a cub. Courage and monetary value are not compatible bedfellows.

The young man who accepts training after being apprised of the responsibilities of this profession is not doing so from the standpoint of the material benefits alone.

By discusing the realities of the pilot officer's profession in the nuclear age, we discharge a responsibility to this young man.

However, we have another responsibility, a responsibility to the people of this country, and to every member of the free world. We are responsible for insuring that the men receiving this vital training, who are later to be entrusted with the responsibility of defending the United States, are the best men our country can provide. To insure this not only requires that the aspirant be physically robust and mentally capable, but that he possesses the will to use the capability and the stamina to obey the will.

No theory or tests yet developed can predetermine the strength of the will as quickly and as accurately as do actual performances. Reactions to problems and exercises under varying degrees of physical and mental stress identify the characteristics desired in or possessed by the aspirants.

No effort should be spared to make effective selection of the potential pilot officer prior to training. The training of this man must not be wasted on the potential washout. Our ultimate combat mission and its vital purpose cannot wait for aborts and losses to weed out the unfit.

The man selected for training must be certain of his desire to serve. He must meet the most rigid requirements and be subjected to rugged and thorough tests to insure his reliability under the conditions he may be expected to encounter.

The next step in preparing the nuclear-warrior-of-the-air is training. The most important adjunct to successful training is the attitude of both the trainer and the trainee.

The trainer of the pilot officer of the nuclear Air Force must recognize this more than ever. If selection has been effective, the trainer is relieved of the necessity of "selling" the many welfare aspects of the Air Force to make it attractive. He is dealing with a man who is aware of his responsibility and is ready to accept the training necessary to prepare for it.

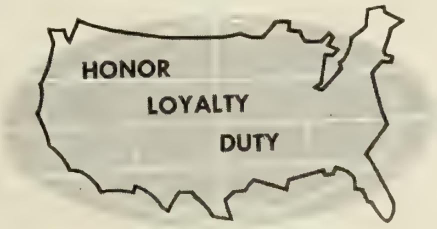
Perhaps the most important training requisite, outside of the skill itself, is discipline. He must live discipline in his training stage until he develops a high state of self-discipline which matches the pattern of discipline required of the Air Force.

The freedom enjoyed by the pilot of bygone days has died with the ages. The technical perfection of today's nuclear armed aircraft demands an attention to duty never before demanded of young officers.

Inattention, tardiness, vacillation, rationalization, procrastination, disinterest formerly tolerated or excused must now be dealt with as habits dangerous to the accomplishment of future missions the man might be called upon to perform.

Efforts during the training should be continuous to discover weaknesses which might endanger a mission.

Efforts to identify aggressiveness,



stamina, courage, decisiveness, obedience to orders and conformance to rules should be continuous throughout the training period, by subjecting the trainee to various problems under varying degrees of pressure.

Why? Why should we depart from our current programs to meet the challenge of the future?

Why can't any man be selected and trained to fly?

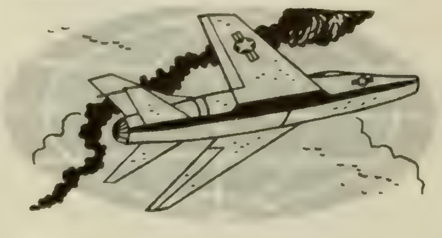
Because the new pilot officer is truly new. No longer will he just lose an airplane because of his pilot error. Nor will he miss the target because of weather, or navigation, or lack of flying ability. He will stop a significant element of an attacking force.

His lack of navigational ability could cause the destruction of a neutral city. His lack of flying ability could cause the destruction of New York City. His inattention, or lack of discipline could cause the wrecking of our war plans. He is a very important young man. He will enjoy a trust and responsibility never before given such young officers. This is, of course, what we require of him.

We, in turn, must provide him with every means within our capability to survive. By thoroughly training him in survival from the time of bailout until his return we insure a more confident man in the cockpit. A man who knows what he will do in an emergency is enabled to devote more time to what he is doing and less to what he'll do if trouble develops.

The attitude toward service, the skill of flying, and discipline for this new pilot officer must be tied together with training as an officer.

There is nothing officer-like in the skill of flying, but the qualities of an officer are involved in what he may be asked to do with the airplane.



- His duty—the attitude with which he performs and the understanding with which he prepares for it.
- His honor—the way he lives, his loyalty to his mission, his superiors and his subordinates.
- His country—his willingness to fight for it, to die for it.

These three truths are as important to the pilot officer as his ability to fly—more important, for his beliefs will determine what he will do with his achieved skill.

This man, the pilot officer, is no different than the pilot officer of the past. He, it will be noted, receives similar training, however, the difference lies in the degree of training. The selection is much more rigid. The gamble on the man's attitude must be removed. We must know. The training must be rigid, and intolerant of a lack of discipline in any degree. The dedication must be complete.

Why is this different? Why must the new pilot officer be so much more of a pilot, much more of an officer than his predecessor? The answer is simple. The consequences of his actions in his position as a pilot officer in the nuclear Air Force are so great that any attempt to find a historical precedent is fruitless. Our country, our people, our service, demands the best of men, the best of training if we are to survive.

A young warrior must prepare himself for war. To do so he must expect war. If war comes he must expect to fight.

He must not be permitted to let other objectives blur his purpose. We, his superiors, must not create doubt in his mind of his primary purposes, his faith in his fighting prowess. Else he will only view his airplane as an interesting vehicle, and not as a weapon in which he gains greater proficiency and skill as a fighting officer.

This new pilot officer must, during the combat phase of his career, prepare personally, spiritually, physically and professionally for war. During the time he represents the fighting man of his country he must be so treated. He should not be confused by career incentives, educational opportunities, retirement benefits and a myriad of other items which today interferes with his primary purposes. These things can come later. This is the requirement. This is the challenge. We know there are such men and we must find them. ▲

★ ★ ★

The Author

Colonel Ritchey has served in the Infantry, Cavalry, Medical Corps, General Staff, Armored Corps and Air Force. As an USAF instructor at the RAF Staff College at Bracknell, England, in 1948, he studied officer military education and training in seven European countries. He has served as Commandant of the Air Tactical School and as Assistant Commandant of the Air Command and Staff College. He is the founder of the Squadron Officers Course at the Air University.

REX SAYS

I DEPARTED a Midwest base in an F-84G, IFR. On climbout I found that I couldn't transmit by voice but I continued on flight plan route in accordance with the last acknowledged clearance.

I didn't want to go all the way with an inoperative voice transmitter so I tried a CW message "in the blind," using the tone button on my UHF set. I requested a change of flight plan to a closer airfield and was surprised to get answers from several CAA stations. One had copied my message verbatim. I asked all except this station to stay off the air and worked him exclusively. He informed me that stations down the line had been notified and approach control at my new destination was standing by for my arrival. An undesirable condition began to look brighter, with this outstanding assistance.

Some five minutes out, RAPCON called me, requesting a mode 3 squawk. Since this had to serve as my only acknowledgment of their transmissions, they had me squawk all the various modes until I was positively identified. Using IFF, this required two minutes at a range of 100 nautical miles and enabled them to give me navigational assistance into their radar penetration pattern. RAPCON was operating several other flights, since the control tower was inoperative, and blowing dust had lowered visibility to near IFR conditions. Each flight used different IFF modes which gave RAPCON better radar returns, and permitted them to work several flights at once.

My penetration took less time than a normal type letdown, and I was handed off to GCA on the downwind. The GCA controller took over with a very reassuring tone to his voice, carrying on the theme "Keep the pilot informed." The letdown was so well planned that I only had to make three azimuth corrections on GCA final approach and became VFR about three out on final, lined up with the runway.

This was the first actual CW message I have ever sent and that CAA station that picked it up was really on the ball.

REX SAYS*—Ingenuity by the pilot and outstanding vigilance by the CAA stations involved, teamed up on this one. It is reassuring to all airplane drivers to know the high calibre of the controllers who run the airways and approach controls. Congratulations to all concerned on a real, heads-up job.*

THIS BASE experienced a near-accident recently which I thought might be of interest to all.

Not too many moons ago, a pilot in a T-33 departed his Northwest base for this one and when he arrived here and extended his gear, the right main indicated unsafe. He declared an emergency, then made a fly-by. Sure 'nuff, the right gear was tucked in real nice. After the fly-by, he pulled up and shortly thereafter, the right gear indicated down and locked. By now, fuel—like time—was of the essence. He landed okay.

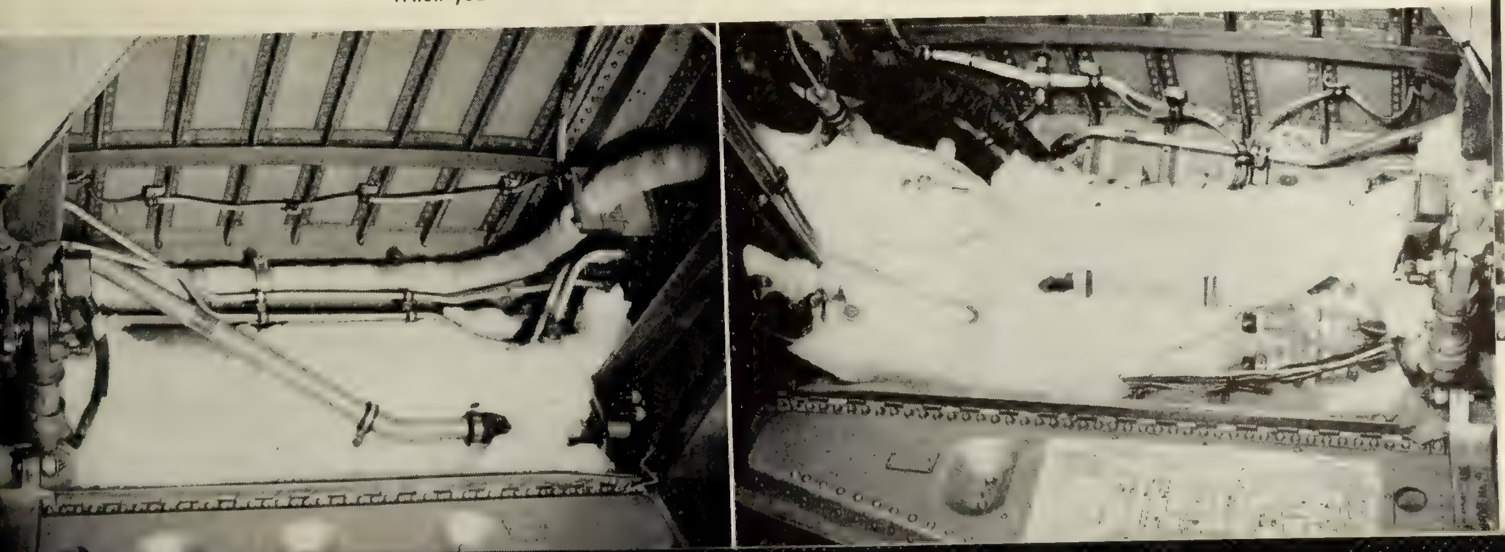
The accompanying photos speak for themselves and show the reason for the gear's failing to extend until the warm air had melted enough ice to release them.

The pilot stated that the ramps and runways were knee deep to a dinosaur in slush when he took off. Apparently quite a bit of this had been thrown up into the wheel wells during the taxi and takeoff.

The Dash One says to recycle the gear several times after takeoff from slush-covered runways and here is proof of what happens if you do not.

REX SAYS*—Thanks for the account. I'm sure happy that you made reference to the Dash One. In most of these near-misses it seems like I am the only one who mentions it and I was beginning to feel like a bore.*

When you take off from a slush covered runway, here is the result.



Before attempting a letdown, best you know what to expect in the way of weather. Here is how to do it.

Dial Channel 13

A PAIR of F-86s were bound for one of our midwestern bases flying IFR 1000 on top. They were cleared to descend to 20,000 feet and proceed to the range station. The weather was reported to be 5000 overcast with 15 miles visibility. Thunderstorms were reported in the area. Upon reaching 20,000 inbound they were on instruments and the radio compass needle was doing nip-ups, because of the thunderstorm activity.

During the descent to 20,000, the ceiling was reported as 1000 feet and it was later revised to 300 feet. Both started the penetration but never became VFR. The leader managed to make it to a nearby base. The wingman lost the leader in the soup, became hopelessly disoriented, ran out of fuel and bailed out.

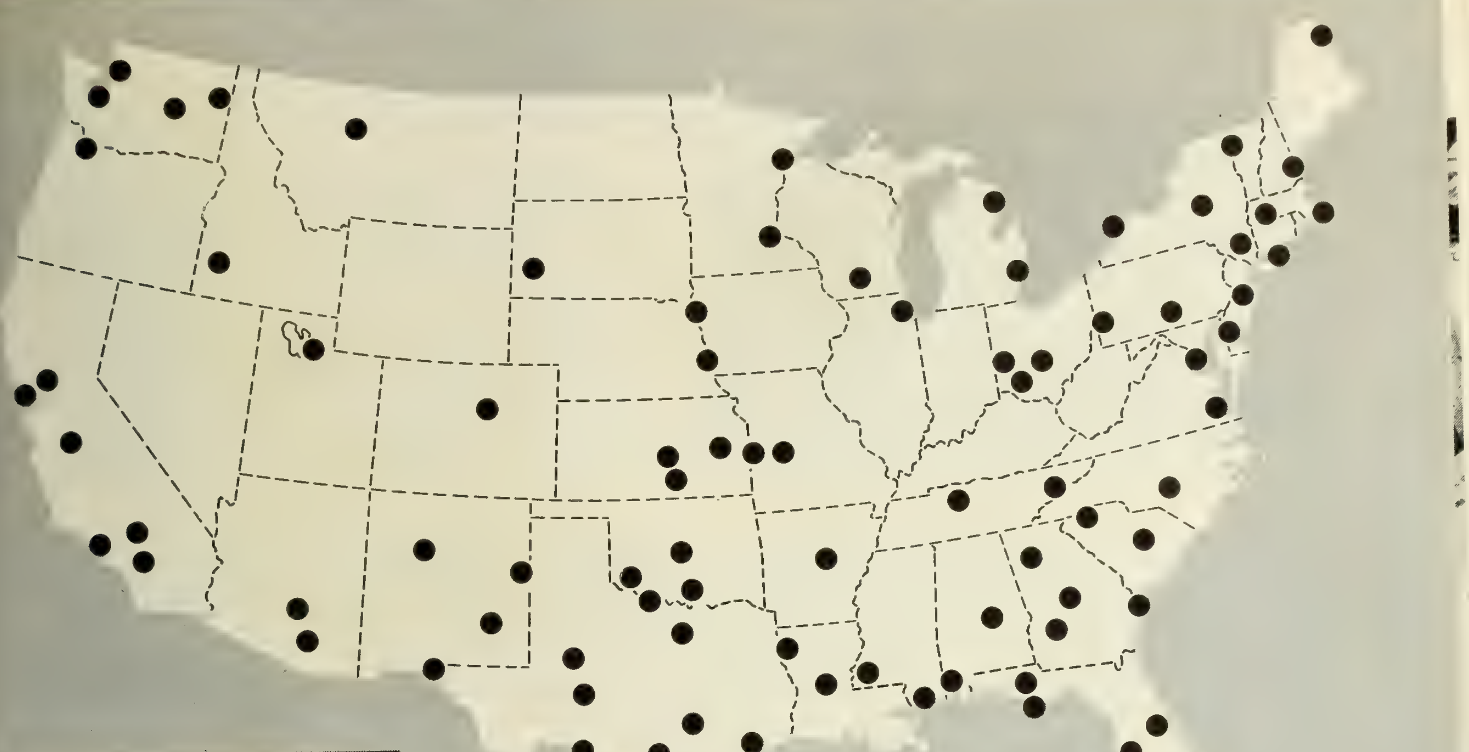
There, folks, are the fast facts. Both of these troops had their share of troubles. For one thing they were both inexperienced, had very little instrument time and had never flown heavy weather or thunderstorms. It appears evident that these two young tigers goofed in attempting a letdown and landing under such conditions. All of these facts, statistics and conclusions appeared on the Form 14 along with the question, Why didn't they use the Pilot to Forecaster Service that was available at that field? (If they had known about the deteriorating weather conditions, it is doubtful if they would have attempted a letdown.)

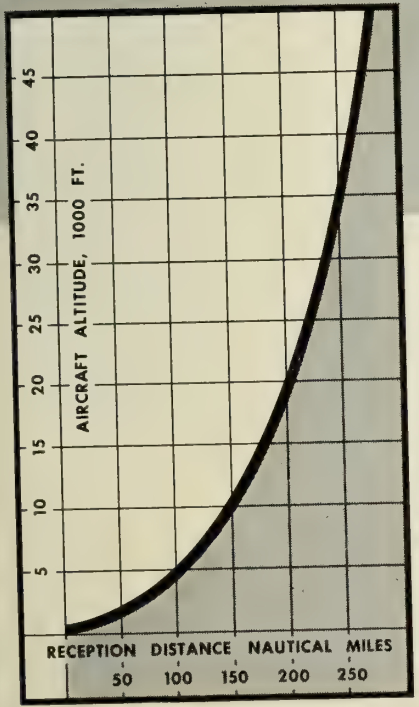
The answer: They both believed this service to be more for the benefit of the weather section than for the pilot. They did not understand it to be a means of getting current landing time weather.

This, incidentally, is not an isolated case and I have the Form 14s to prove it.

There is no doubt that the modern air-bird requires a considerable amount of support, including maintenance, navigational assistance and adequate weather information. Of course, with jet type aircraft, and their rapid fuel consumption, accurate terminal and en route weather information is imperative. There are two basic types of information that a pilot can receive from a weatherman. One is an observation and the other is a forecast. Picking up the observation while tooling along is old hat. I think everybody is indoctrinated on listening to the weather reports given by the range stations 15 or 45 minutes after each hour. Also, pilots call a station periodically and get the latest terminal weather. What you receive, of course, is the latest observation and must not be confused with a terminal forecast. (You can, of course, specifically request a forecast.)

Also, your weather briefing prior to takeoff includes the observation for your destination and alternate, along with a forecast for your ETAs. I don't believe any weather heads will get "shook" if I say that occasionally a forecast is busted. (See "Weather or




AIRCRAFT ALTITUDE, 1000 FT.
5
10
15
20
25
30
35
40
45
RECEPTION DISTANCE NAUTICAL MILES
50
100
150
200
250

Above, is a map showing the coverage of PFSV throughout U.S. At left, notice the UHF range you can expect at various altitudes.

Not," FLYING SAFETY, October 1956.) Anybody with any flying time at all can recall the time he leaped off to a place destined to be VFR and upon arrival had to change to IFR and shoot a letdown. It is common knowledge that our forecasters do a good job with what they have to work with. However, the science of forecasting weather just hasn't advanced to the stage where you can expect 100 per cent accuracy.

Your best chance of obtaining an accurate forecast is to get the very latest one, and the way to do that is to use the Pilot to Forecaster Service.

It matters little if the weather is reported as VFR when you are some 20 minutes out, the important thing is: What will it be when you are completing your letdown and looking for the hard surface?

A fast look at the map accompanying this article gives you an idea of just how many PFSV stations are available. They have been located so that you are always within range of at least one.

It figures that the forecaster cannot originate this service, so the responsibility rests with the pilot. Since you must guard the appropriate ARTC frequency, first get permission to switch to channel 13, then have at it! The "Remarks" section of the Radio Facilities Charts, both the bound volume and the Special Edition, carry the information on facilities available. Incidentally, it is a pretty fair idea to check this during your preflight. Make an entry on your nav log of what stations en route will provide this service. Then, when needed, it will be real handy.

A sample of the correct transmission procedures follows:

"Scott Forecaster, this is Air Force Jet 12345, over."

"Air Force Jet 12345, this is Scott Forecaster, over."

"This is Air Force Jet 12345, request Scott weather and landing forecast for 1510C, over."

"This is Scott Forecaster, Roger, stand by."

"Air Force Jet 12345, this is Scott Forecaster. The latest Scott observation, 1430C is 4000 ft scattered, 10 miles visibility, surface wind SSW-14 gusts 22 knots, altimeter setting 29.98, line of thunderstorms 3 miles to northeast. Landing forecast for 1510C, 800 ft broken, ½ mile visibility in rain showers, surface wind N-40, altimeter 29.96 with thunderstorms in all quadrants, over."

"This is Air Force Jet 12345, Roger, alternate is Grandview, request latest observation and landing forecast for 1525C at Grandview, over."

"This is Scott Forecaster, Grandview observation at 1430C is 5000 ft broken, 10 miles visibility, surface wind

U. S. STATIONS WITH PILOT-TO-FORECASTER SERVICES AVAILABLE

Altus Air Force Base, Oklahoma
Amarillo Air Force Base, Texas
Andrews Air Force Base, Maryland
Ardmore Air Force Base, Oklahoma
Barksdale Air Force Base, Louisiana
Bergstrom Air Force Base, Texas
Biggs Air Force Base, Texas
Brookley Air Force Base, Alabama
Burlington, Vermont
Carswell Air Force Base, Texas
Castle Air Force Base, California
Clinton County Air Force Base, Ohio
Clovis Air Force Base, New Mexico
Davis-Monthan Air Force Base, Arizona
Dobbins Air Force Base, Georgia
Donaldson Air Force Base, So. Carolina
Dover Air Force Base, Delaware
Duluth, Minnesota
Eglin Air Force Base, Florida
Ellington Air Force Base, Texas
Ellsworth Air Force Base, South Dakota
England Air Force Base, Louisiana
Fairchild Air Force Base, Washington
Forbes Air Force Base, Kansas
Foster Air Force Base, Texas
George Air Force Base, California
Grandview Air Force Base, Missouri
Greater Pittsburgh, Pennsylvania
Goodfellow Air Force Base, Texas
Griffis Air Force Base, New York
Hamilton Air Force Base, California
Harlingen Air Force Base, Texas
Hill Air Force Base, Utah
Hunter Air Force Base, Georgia
Kelly Air Force Base, Texas
Keesler Air Force Base, Alabama
Kirtland Air Force Base, New Mexico
Lake Charles Air Force Base, Louisiana
Langley Air Force Base, Virginia
Laredo Air Force Base, Texas
Larson Air Force Base, Washington
Laughlin Air Force Base, Texas
Little Rock Air Force Base, Arkansas
Lockbourne Air Force Base, Ohio
Loring Air Force Base, Maine
Lowry Air Force Base, Colorado
MacDill Air Force Base, Florida
Malmstrom Air Force Base, Montana
March Air Force Base, California
Maxwell Air Force Base, Alabama
McConnell Air Force Base, Kansas
McChord Air Force Base, Washington
McGhee-Tyson Airport, Tennessee
McGuire Air Force Base, New Jersey
Mountain Home Air Force Base, Idaho
Minneapolis-St. Paul Int'l, Minn.
Niagara Falls NAS, New York
Offutt Air Force Base, Nebraska
O'Hare Int'l Airport, Illinois
Olmsted Air Force Base, Pennsylvania
Otis Air Force Base, Massachusetts
Oxnard Air Force Base, California
Paine Air Force Base, Washington
Palm Beach Air Force Base, Florida
Pinecastle Air Force Base, Florida
Pope Air Force Base, North Carolina
Portland Int'l, Oregon
Portsmouth Air Force Base, N. H.
Robins Air Force Base, Georgia
Selfridge Air Force Base, Michigan
Sewart Air Force Base, Tennessee
Shaw Air Force Base, South Carolina
Sheppard Air Force Base, Texas
Sioux City Air Force Base, Iowa
Smoky Hill Air Force Base, Kansas
Stewart Air Force Base, New York
Suffolk County Air Force Base, New York
Tinker Air Force Base, Oklahoma
Travis Air Force Base, California
Truax Field, Wisconsin
Turner Air Force Base, Georgia
Tyndall Air Force Base, Florida
Walker Air Force Base, New Mexico
Webb Air Force Base, Texas
Westover Air Force Base, Massachusetts
Whiteman Air Force Base, Missouri
Williams Air Force Base, Arizona
Wright-Patterson Air Force Base, Ohio
Wurtsmith Air Force Base, Michigan

NW 10 knots, altimeter 29.99, landing forecast for 1525C, no change in remaining elements from observation given, over."

"This is Air Force Jet 12345, Roger, I will land at Grandview. when do you forecast Scott to have 2000 ft and at least 3 miles visibility, over."

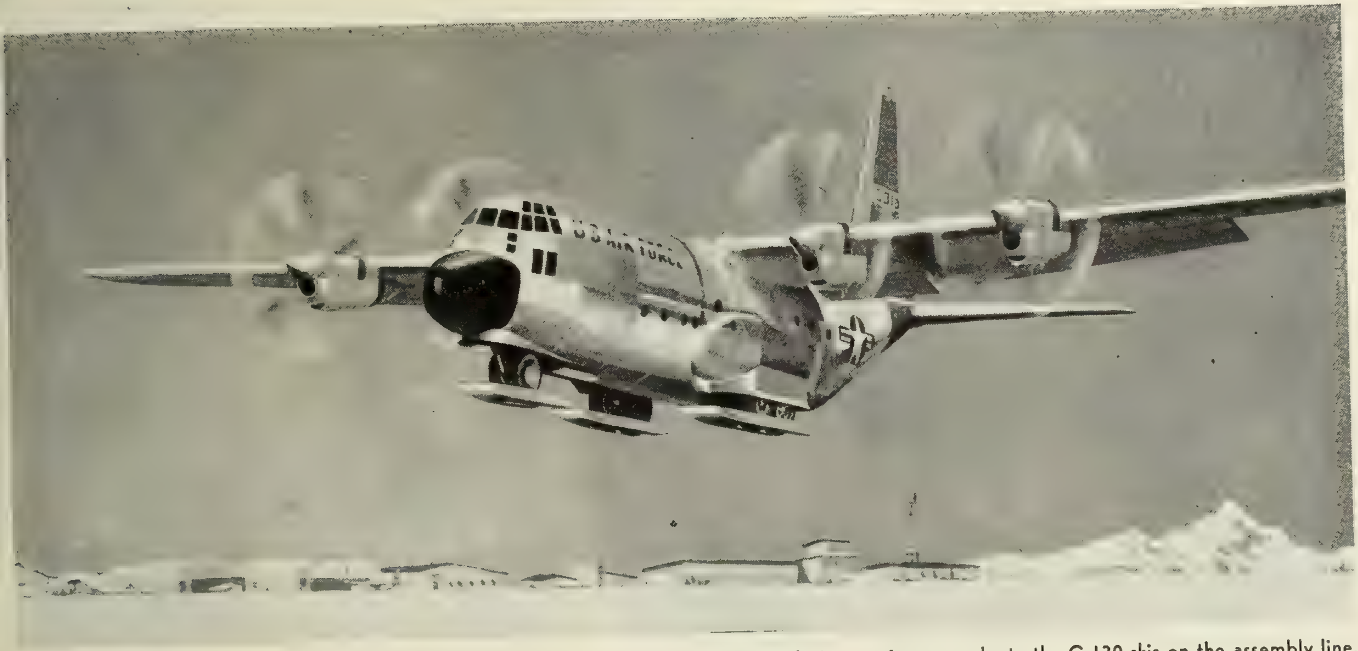
"This is Scott Forecaster, Scott will have 3000 broken, 5 miles visibility by 1630C and continue to improve, over."

"This is Air Force Jet 12345, Roger, and out."

Well, there you have it. Just remember, get that current forecast prior to committing yourself to a letdown, monitor your destination and alternate weather while flying en route and live to be part of the crew selected to take the first flight to the moon in 1985. ▲

Keep Kurrent

NEWS AND VIEWS



Above, design engineers evaluate the C-130 skis on the assembly line. Below, is the aircraft in flight without the versatile ski configuration.

TAC's Workhorse — The largest skis ever made for aircraft are being fitted on the C-130. They are designed for use in the Arctic and Antarctic regions. The installation includes a "knee action" that will serve as a cushion when the big, prop-jet-powered transport touches down on the ice. The "knee action" simulates the absorbing effect which the aircraft would get from tires in a normal landing on a concrete runway.

With the skis, this new workhorse of the Tactical Air Command's 18th Air Force will have the ability to land on any type of terrain from rough, hastily prepared fields to sand and ice caps.

Each ski resembles a small landing craft. A mere flick of a switch by the pilot will change the landing gear from conventional wheels to the skis, or from skis to wheels. This arrangement will enable the pilot to take off from a dry concrete runway and land on any type of snow from deep, soft slush to hard, weathered snow of the polar ice caps. Or, he can make a ski takeoff and then land where he needs conventional wheels.

Each of the main landing gear skis are 19½ feet long, 5½ feet wide, and weighs 1700 pounds. The nose ski measures 9½ feet long and 5½ feet wide. All three skis add 4000 pounds to the net weight of the C-130. Even with this additional weight, this aircraft will still maintain its outstanding performance.

Its speed, which is better than 370 mph, is not appreciably reduced. For ground operation, the nose ski turns and acts just like nose gear steering. It will turn 30 degrees in either direction.

IT WAS a hot, August day at Hamilton, and Lou was up for his second ride in the recheck series after having recently reported in from Tyndall. Checkout for him had been the long route via Blueflame. They teach you a lot about the Dog down there and even more about the all-around function of an ADC pilot. The fact is, you spend about 10 hours at the related functions for every hour you get in the '86. This was all behind now; a routine unit recheck would launch Captain Lou Wilson on his new career of jet pilot.

A part of the adjustment, of course, is accepting the inevitable status of "Junior Birdman," which comes with every new flying assignment. In this instance, it was going to be a long road because Lou was 35 years old and had no previous jet experience. The initial reception had been cordial enough but the overall attitude was unmistakably cool. It seems that some line drivers consider the Blueflame program to be a good one for MATS and SAC but hardly the thing for lead slots in fighters. Lou was deep in these thoughts when he heard himself being paged to the briefing room.

The briefing was thorough but concise. He was given a mission card outlining the entire flight. Captain Jones said that he was going along. He'd be minding his own business off to one side, but if Lou needed any help at all, to give him a call. He was told to use a 30-second spread on takeoff. Loose formation would do on the way out, just to get the feel.

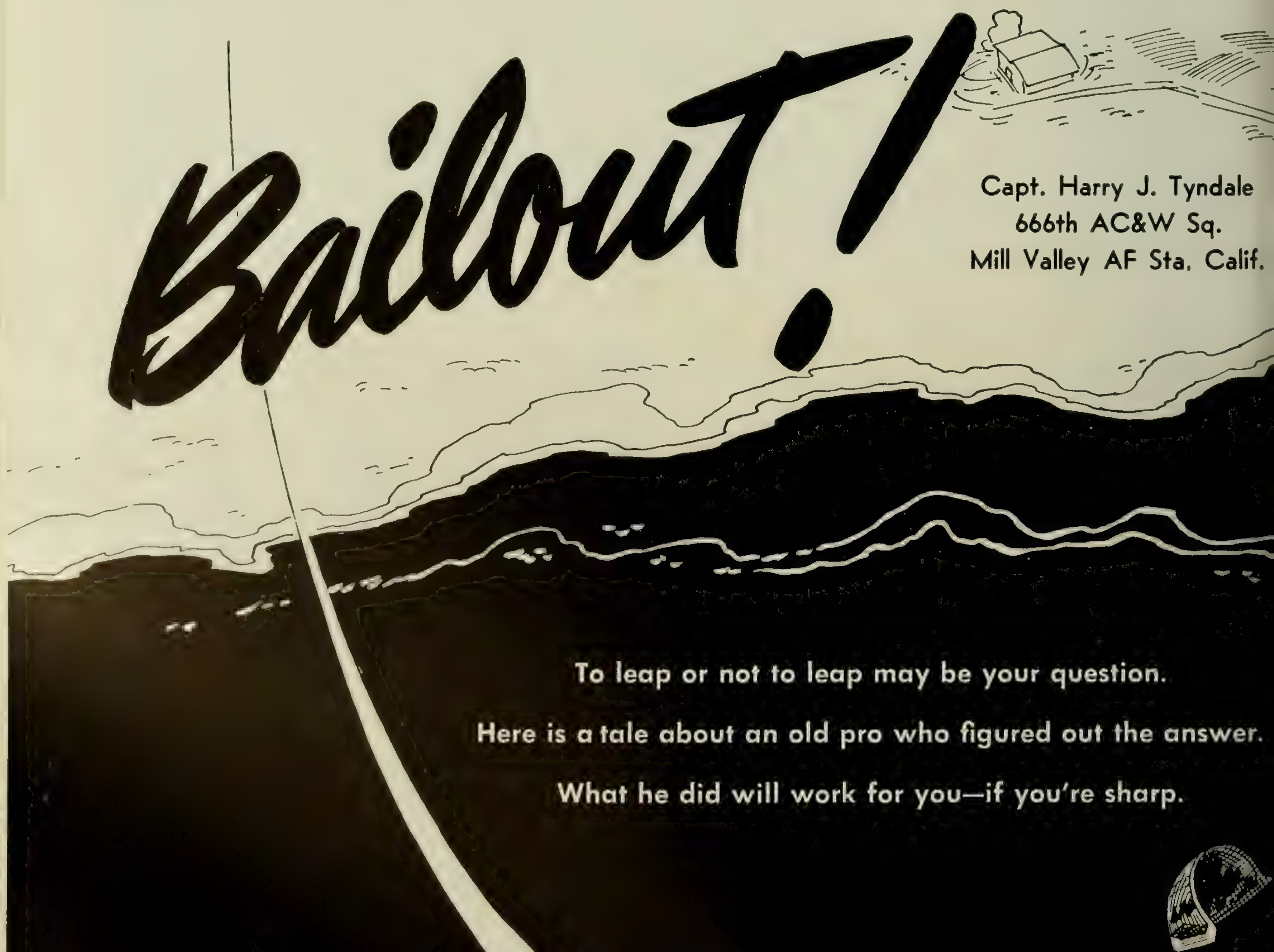
Lou moved into position on the upwind side. Runup checkout, looks okay, he thought. Afterburner lit, everything looks good, 30 seconds plus, let 'er go . . . 100 knots, lift the nose just a little now, let the speed build. Okay, now fly. Gear coming up and all's well. As he glanced forward, he noticed that lead would soon be turning.

Returning to the panel, Lou saw that it was time to get the flaps up. After lifting them, he looked up again to locate the leader for turning reference. As he did this, he heard some excited but garbled voices on the air. At the same instant, his attention was commanded into the cockpit by that big red light. The radio came in again —this time five square.

"Red, Two—you're on fire. Red, Two, do you read?"

"Roger," answered Lou, in a tone as disgusted as he was over his loss of hope for a light malfunction.

Hope they scramble the boats, he thought, as he pulled the nose up sharply. This will be my first swim this year. Easy now, Dad, stay cool and stay awake. This one has to be fast. Heavy G momentarily, eh? Well, I can still put a good squeeze on the old gut. Speed 140, nose nice and high, better go! Lifting the handle, he squeezed everything.



Bailout!

Capt. Harry J. Tyndale
666th AC&W Sq.
Mill Valley AF Sta. Calif.

To leap or not to leap may be your question.

Here is a tale about an old pro who figured out the answer.

What he did will work for you—if you're sharp.

Get out of this seat, quickly, he commanded himself. Never mind where you are. Get that 'chute open.

Realizing that the D-ring was free, he concerned himself with the parachute. "Come on, dammit. Pop! Ooooh! And some people say you never even feel it. Let's see now, don't try to swim, just get a good breath and slip the harness under water." This didn't seem too difficult, he thought, as he wriggled out and pulled both cartridges on his Mae West. He wondered if he'd come up under the 'chute. He didn't. As a matter of fact he hadn't even noticed where it was. I'd better get to a phone—quick, he thought. Helen will flip if anyone else calls. A swamp glider was bearing down on him by now and Lou discovered that he could only wave one arm and still stay afloat.

Everyone was smiling and they really crowded him as he climbed to the dock. In unison, they asked the same question: How had he made it from such low altitude? Lou had the distinct feeling that he had been given credit for a miracle.

The investigation and board will be a mere formality, he was told. After all, what can they learn from an accident like this? A fire on takeoff and the world's luckiest pilot. That's all there is to it. Lou recalled these words as the first hour went by at the board hearing.

"Why did you bailout instead of ditch?" had been the lead question.

"I won't ditch unless I have to," answered Lou.

Didn't he feel that he was too low to bailout, he was asked.

"No, I had plenty of speed and power and I knew I could make it if I stayed awake."

"Are you aware of the statistics regarding ejection fatalities?"

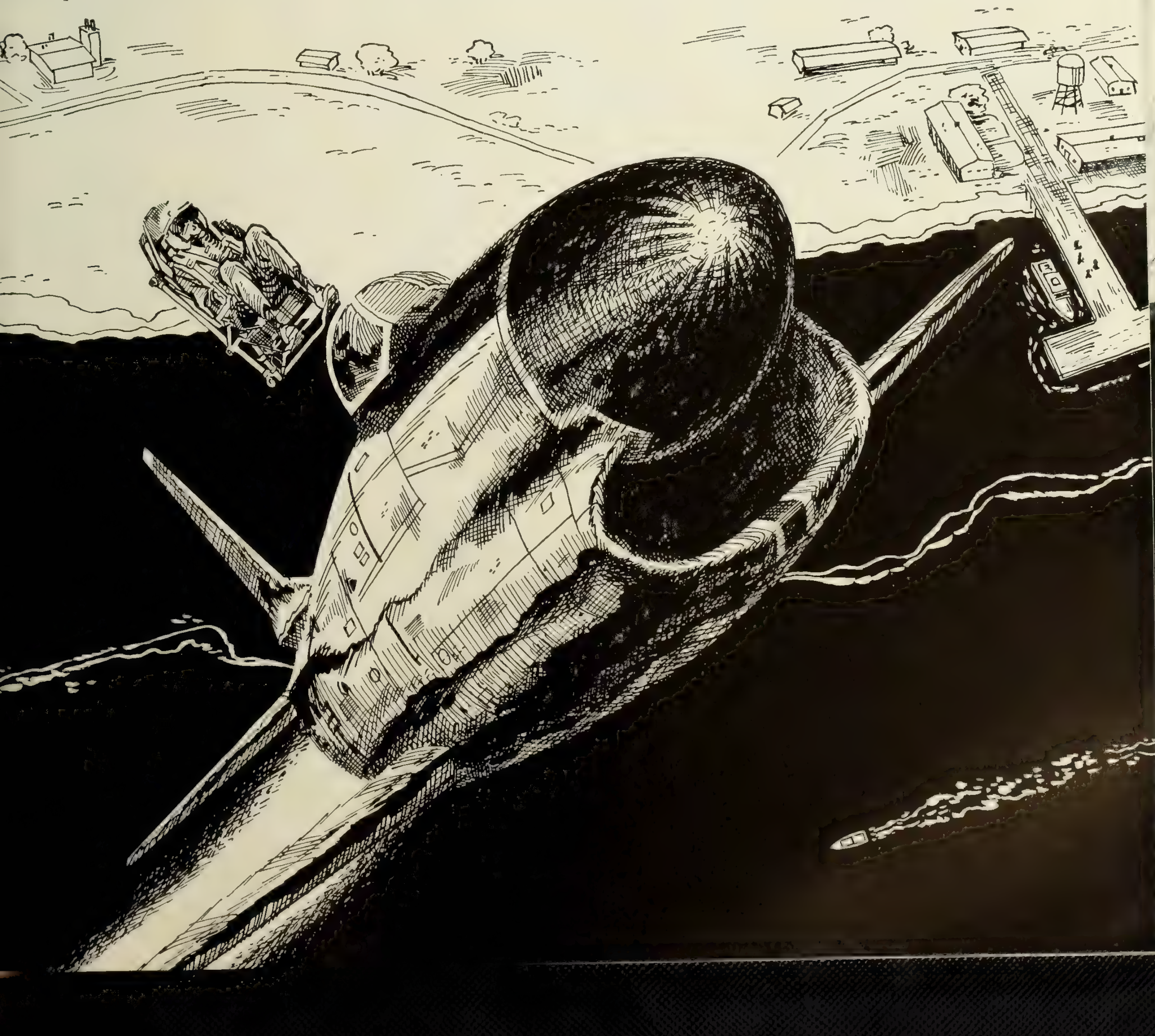
"Yes, Sir, I've read some dope on the subject. The trouble with the stuff I read was that they didn't give the full story behind each attempt. They probably didn't have the story. All I know is that you can't mould your actions around dry statistics."

"Just what is your minimum altitude for bailout, Captain Wilson?" asked the investigating officer.

"I don't have one, Sir, at least not in those terms. The way I figure it, you don't jump from an altitude; you jump from a situation."

"Please continue, Captain Wilson," invited the president.

"Well, Sir, altitude is a meaningless dimension in many cases. It is not the prime factor for bailout decisions in many cases and most certainly is not in the case of bailout on takeoff. After all, it's a foregone conclusion that you don't have altitude during the early stages of climbout. The two things you do have are speed and power. These, after all, are nothing less than altitude potential in an airplane. All of you must realize that



it isn't really altitude that opens a parachute; what you need is time in an airstream. The time element is the key to survival because it takes time to free yourself and release the 'chute to the airstream. If you have the minimum amount of speed and power you can give yourself time in the air. The question then becomes, 'What is the minimum situation?' This, of course, is a very difficult one to answer. The biggest variable is the amount of time required by the different pilots.

"I can only speak for myself because this is one of the many areas where each pilot must make his own decision. The way I see it, the dangers are over-rated. Many people consider themselves critical until they pass 1500 feet, or some other figure. Presumably, if they get in trouble below this, they will return to the field. To me, this is not only unrealistic but dangerous. I figure that I'm critical until my flaps are up. This cycle is completed while still over the runway. If anything goes wrong before this, I'll set it down at all cost. The flaps clean up at a pretty good speed. The worst thing that could happen would be a flameout. In this case I doubt that you'd have any choice but to go in straight ahead. So, we'll consider this as the beginning of the real critical zone of operation. Now you must select the speed which would give a few hundred feet of pull-up without power, as in a flameout condition. I think you'll all agree that in jets the recommended climb speed will do this easily. This means then that you're really only critical between flaps up and climb speed. This conclusion is drawn with one important assumption—that bailout will be accomplished in fast time."

The board president raised his hand to ask, "Do I understand that you have a firm speed, above which you'll attempt a jump?"

"No, Sir, the decision rests with the speed-power combination. A little speed with a lot of power or more speed with less power. I simply pointed out a convenient speed which I believe to be a safe minimum in case of total power loss. For example, 300 knots with no thrust might provide a rising exit at 300 feet, in a 45 degree trajectory. While 200 knots with full power might provide the same thing."

"Since you're talking in terms of feet now, tell us, do you consider 300 feet to be sufficient for bailout?"

"Under these conditions, I certainly do. You leave the aircraft traveling at a good angle upward and at a good speed. You will continue upward for some time before you start down. There is ample airstream present because you have a good horizontal speed component. All you need is the time to free yourself and turn the 'chute loose."

"If it's that simple, I can't see why so many people were unsuccessful," commented one of the board.

The Individual

"Well, Sir, I've been talking about what can be done by a man who knows beforehand what he intends to do. I think you will all agree that a large number of our pilots presently have different views than I, in this regard. When an emergency occurs at a time not covered by pre-planning, or if the pre-planning does not call for bailout, then you have a completely different problem. You must then consider the human delays such as reevaluation of the situation, decision and the coordination delays which accompany spontaneous moves. In addition, you must recognize the strong effect of subconscious fear which is bound to be present in the mind of a person who is ejecting."

Lou paused to offer an opening for any taker. There appeared to be none.

"Gentlemen, it is my opinion that a pilot who actually believes that he needs 1500 feet would probably kill himself if he were forced to jump from any lower altitude." (This statement brought all of them to the edge of their seats.) "Suppose one of these pilots had just taken off and his engine blew as he was passing through 1200 feet. What would he do? His mind was made up that he wouldn't jump below 1500 feet. He knows that indecision is a very dangerous thing so he would make his move as preplanned. The moment he rolls into his turn for the field he is committed to the ground. This is so, because the turn will consume any excess of speed that he has. In addition, if you're going to ride it in, you must reduce the power to avoid aggravating an already bad situation. We now have an airplane in a low speed descent at reduced power, somewhere below 1200 feet. This pilot no longer has an option and I will agree with anyone who says he wouldn't have a chance. Bear in mind, gentlemen, we are analyzing the actions of a pilot who had no intention to jump at this time. Only complete catastrophe could drive him from the cockpit. If it did, how effective would he be in his attempt? I believe that there is every probability that his fear would come forth in panic to some degree. Such cases as failure to get free of the seat, opening the 'chute before unbuckling and other such tragedies lend strong support to my belief in this regard."

It was obvious by the expressions that the entire board was in agreement with this logic. The president was first to break the silence.

"Yours is a particularly keen insight to the problem, Captain Wilson. Can you think of any effective way in which we might present your opinions to others who are concerned?"

"No, Sir, I can't. Judgment is very personal property. It's not transferable. Each pilot must develop his own around the facts which apply to each situation. I might accentuate the word 'fact' however, because there is a great quantity of conjecture and opinion in this business. It's not a healthy situation when many people are betting their lives on 'impressions' or 'opinions' of other persons."

"Do you think there is enough guidance material in the field?"

"Sir, so much has been written and so much has been required reading that some pilots get mental indigestion at the sight of a new piece of paper. If there is a short circuit in the information system, I believe it to be the destructive effect that our 8 to 5 schedule has had on the old 'hangar flying' schedule."

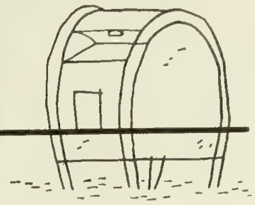
"Thanks very much, Captain Wilson. We'll try to find a way to cause our pilots to think about this subject."

With that, Lou was excused from the meeting.

Lou sensed an entirely different atmosphere as he entered operations this time. He knew from the smiles and horsing around that he had suddenly been accepted as a full fledged jet pilot. The smile that crept to his face however was actually the result of reminiscence. It was just about 12 years ago that Lieutenant Lou Wilson had crashed an equally tight fraternity . . . the order of Red Hot Fighter Pilots. The only real difference was that the plane he left in '44 had thrown a rod. This one threw a few turbine blades. ▲

CROSS FEED

LETTERS TO THE EDITOR



★ ★ ★

How True

We read Major Robert E. Fuerst's article "The Voice From Below," (FLYING SAFETY, June 1956) on a "save" by Naha GCA, and enjoyed it immensely as we believe that AACS organizations do not receive enough credit for the number of aircraft that are "saves." However, we feel that the Major has included a little fiction in his story when he implies that the aircraft was saved because of GCA Circular Polarization at Naha.

Naha GCA gave a Surveillance Approach to Kadena by use of Surveillance Radar. To our knowledge Circular Polarization is available on Precision Equipment only and not on Surveillance. Gilfillan Brothers, Inc., would be greatly interested in Naha's Circular-Polarization if said approach was made with Surveillance Radar.

M/Sgt Maynard R. Claussen, AFSC 27270
M/Sgt Donald W. Hubert, AFSC 27272
Tainan ABAT, Taiwan

Oops! . . .

★ ★ ★

Touched

After reading the article by Tony LeVier in the November issue, I know a lot more about the F-104 now than I did before. It certainly seems like a pilot's aircraft from his description.

From a maintenance standpoint, the aircraft represents a step in the right direction, the way I see it, as to simplicity of the modern fighter plane. It is very good to see examples of good maintenance design like the fold down hydraulic panel, simple nonpowered canopy and such features. If the F-104 is as easy to keep in the air as Tony LeVier says it is to fly, we should have a real fighter. Incidentally, when is it expected to be in squadron service, and with what commands, or is that classified?

Please do not let Colonel Mulholland escape completely from writing for the magazine. His "Recognition of Error" was a gem. The style of writing he employs with its overtones of humor, and what he says make for extremely interesting reading. I especially enjoyed the OA-12 incident, and the way he used it to make his point.

About the errant prop control he said, "On a hasty pre-takeoff check, the knob appeared to be in the full forward position." This illustrates the folly of visually going through your checklist on movable engines control knobs. When flying as an engineer on C-54s on the Berlin Airlift, and sometimes tired and drowsy, I was guilty of not touching (and/or trying to move to their required position) certain checklist items like we were always taught to do, and just taking a quick glance at them as the copilot called them out. This can get you in serious trouble, as Colonel Mulholland points out, especially at night.

I think you are making FLYING SAFETY very interesting; so please keep up the good work.

M/Sgt Harry E. Lyon
P. O. Box 77
San Marcos, Texas

Your kind words are appreciated. Lt. Col. Mulholland 'flew the coop' and is now assigned to Westover. Everybody enjoyed his fine articles.

★ ★ ★

Paper Parade

Referring to the article "The Down to Earth Approach" (FLYING SAFETY, October 1956), may I make a brief comment on behalf of aviation operations personnel in all the services?

The bound type publication is far superior to the loose leaf type inasmuch as countless manhours will be saved by receipt of a revised book each month in place of a seemingly endless parade of loose leaf changes.

In addition to the labor-saving aspect, there is also the advantage of maintaining a complete and up-to-date publication, not a book which has been raided by individuals who need a certain page but don't care to carry or handle the entire book.

Adoption of the bound type publication for Instrument Approach Procedures would certainly be welcomed by aviation operations personnel as a great boost to efficiency as well as flight safety.

T/Sgt Albert S. Greene
584792 USMC
NAS Atsugi, Japan

Anyone else care to comment? The pros and cons on loose-leaf vs. bound type is shaping up into quite a battle.

★ ★ ★

A Kit for a Dane

We were very glad here in the 729 FB Sq when we saw in your magazine that you wanted our direct mailing address. We, the pilots, want the topics "red hot" but you can imagine they seldomly are if they go through the ordinary channels from California to Denmark, so here is my address:

Incidentally, Sir, if you want to hear of the good shows that are put up over here I shall be very glad to furnish you with information. For example one of our boys, Lt. B. G. Pedersen landed no sweat without elevator control quite some time ago, after having read in "Flying Safety" how Colonel Bodecker did it at Luke in the same type aircraft.

2/Lt Per Alkaersig,
729 F-B Sq Skrydstrup AFB
Royal Danish Air Force

You've been put on the mailing list. FLYING SAFETY would welcome some of your "Good Shows."

Air Discipline is something we must have. Here is a word on just how important it is—along with how it should be achieved.

(This article is reprinted from COMBAT CREW.)

the Word on Air Discipline

Major General Archie J. Old, Jr., Commander, 15th Air Force, March AFB, Calif.

Major General Archie J. Old, Jr., Commander of the 15th Air Force, is particularly well qualified to write on the subject of air discipline. Among other outstanding accomplishments, he was DCS/O of the Strategic Air Command when it was transitioning from B-50s to B-47s. This was highly successful. Without strict air discipline during this period, it could have been a real hairy affair. More recently, General Old was Air Commander of the first round-the-world flight of B-52s. The success of this mission alone demonstrates the efficacy of his doctrine.

THE ONE FIELD of aircraft accident prevention which demands the closest attention and at the same time has the potential of yielding the greatest results is the minimizing of accidents caused by a lack of discipline. Many factors are involved in accidents which have been assessed to this lack of discipline: Deviation from established procedures, lack of crew discipline, insufficient knowledge of emergency procedures, faulty mission planning. No one cure-all will totally remedy or remove these cause factors, yet the very existence of these flaws is indicative of an over-all deficiency, a lack of discipline.

There are a number of definitions for discipline. But the two words I feel most significant are "compliance" and "obedience."

Discipline is the result of training, supervision and experience. If our crews are to operate Air Force aircraft with a high degree of safety and with consideration for personnel and equipment under their direct control, it is absolutely essential that discipline be maintained to the highest degree. It is a proven fact that discipline will greatly reduce the accident rate and save costly equipment. The cost of our annual equipment losses amounts to a staggering sum. But let us consider the most important point—human life. We cannot replace human life nor can we place a price tag on it. This loss of life depletes our nation's vital resources and cannot be justified.

Whenever a pilot feels that he has complete mastery of the air and a supervisor or commander feels that his unit has reached the acme of perfection, their value to the Air Force has ended. An attitude such as this is a false sense of security and cannot be condoned. I say this because complacency reaps a grim harvest.

We must ask ourselves the question, "Is there a difference between air discipline and ground discipline?" If discipline means "compliance and obedience," then air and ground discipline are basically the same.

If discipline is demanded on the ground and becomes part of our daily routine, then air discipline will be automatic. I use the terminology "air discipline" because it is this lack of discipline in the air that has cost us such severe loss of life and equipment.

I would like to review briefly a few of the items which are directly related to air discipline: Knowledge of directives and standard operating procedures. Application of knowledge and training. Sound judgment. These are the main points which have been cause factors in many of our accidents. What is the answer? Why are our crews failing in this area? The answer is obvious: Commanders and supervisors are failing to demand "compliance" and "obedience"—the fundamentals of discipline.

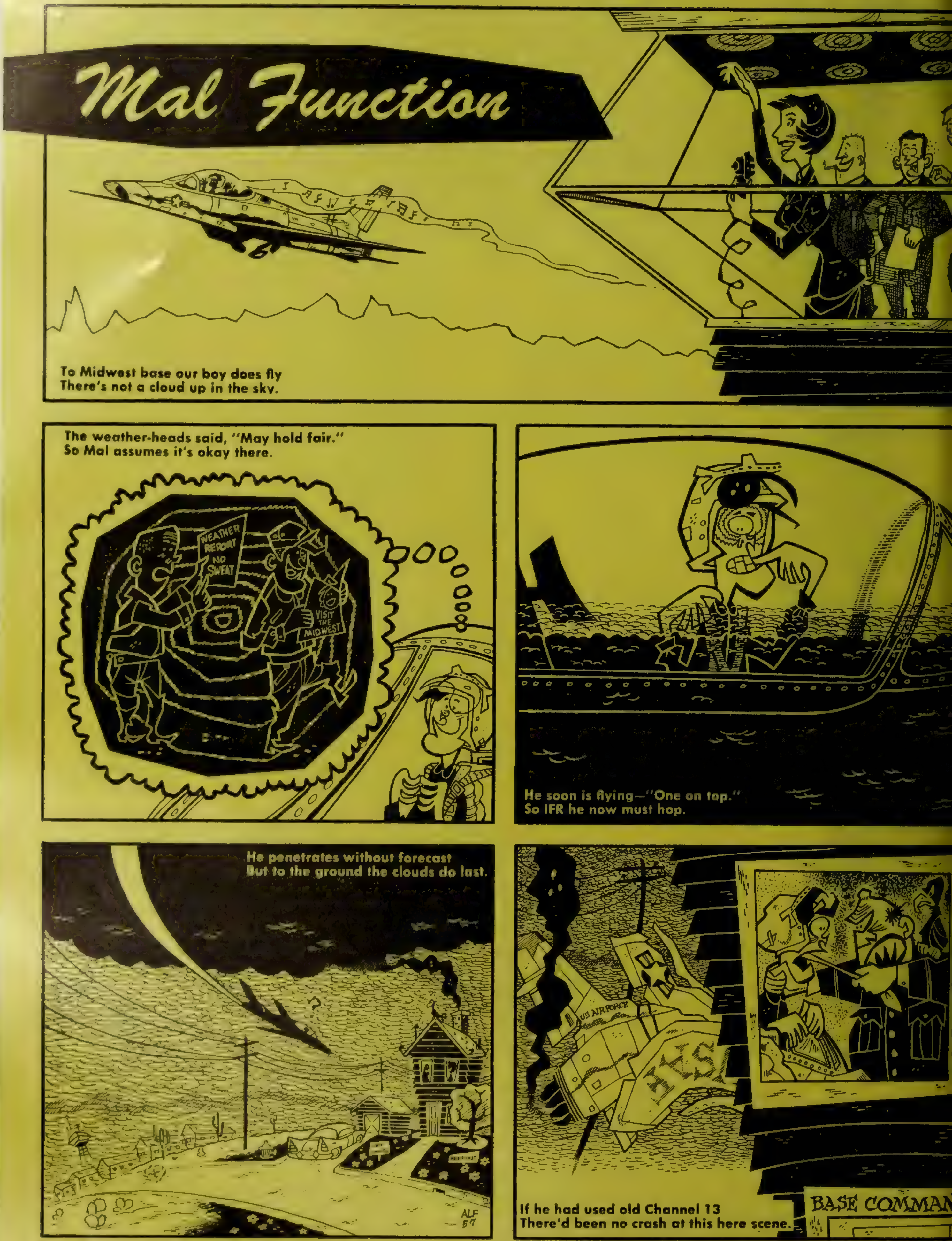
The aircraft commander is a commander and supervisor and must exercise control of his crew. If he fails to comply with the principles of discipline, he certainly cannot expect discipline from his crew. Noncompliance is a direct result of lack of self-discipline. This lack of discipline casts reasonable doubt upon our Air Force's capability to execute its ultimate mission when crews will obviously be confronted with extremely difficult obstacles requiring a high state of discipline.

Can we afford to waste manpower and equipment which are so vital to the maintenance of global security when this loss is attributed to a violation of the fundamentals of discipline? We are all directly responsible for maintaining the highest degree of combat potential possible. This can only be achieved through our complete acceptance and practice of AIR DISCIPLINE. ▲

take a look...

at page 4 to see how the new pilot fits into the aircraft accident picture. These young officers are the backbone of our striking power. They are also the ones having the majority of our aircraft mishaps. That is why they are featured as February's part in the Aircraft Accident Program for the year 1957.

Mal Function



To Midwest base our boy does fly
There's not a cloud up in the sky.

The weather-heads said, "May hold fair."
So Mal assumes it's okay there.

He soon is flying—"One on top."
So IFR he now must hop.

He penetrates without forecast
But to the ground the clouds do last.

If he had used old Channel 13
There'd been no crash at this here scene.

U. S. GOVERNMENT PRINTING OFFICE . . . 402039

305
5

FLYING SAFETY

UNITED STATES AIR FORCE

MARCH 1957

THE LIBRARY OF THE
APR
UNIVERSITY OF ILLINOIS

Your New Airplane

File Thirteen

As depicted by our cover, March is "Your New Aircraft" month. During the period that you're transitioning to a new or different flying machine, you're highly vulnerable to accidents. Regardless of your total flying time, checking out in a new bird can louse up your accident record unless you play it cool. We have more to say about this on page 1. . . . *Flying Safety Officers*, keep your eyes peeled for an item in the Flying Safety Officers Bulletin in the April FSO kit. The subject is homing beacons situated fairly close to each other and having a frequency spread of only a few kcs. There are advantages and disadvantages with this set-up. The advantage being the ease of tuning close proximity frequencies within a control area. The disadvantage is the possibility of tuning the wrong beacon. The answer to the disadvantage, of course, is to *always identify the station*. . . . Crash landings by the F-89 on unprepared surfaces have always called for "gear up." It's fairly well accepted that gear down is the best procedure on fighters; however, in the '89 the nose gear would enter the cockpit and pin the pilot. Now, T.O. 1F-89-615 requires modification of the nose gear drag link. It provides a fail point in the link, thus precluding the possibility of the gear strut entering the cockpit. There have been two accidents proving that the fail point does operate as designed. So, if you drive Scorpions, check to see if this modification has been made.

Perry J. Dahl

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Please send Flying Safety Magazine for one year to the following address. Enclosed is a check or Money Order for $2.50. ($3.50 for foreign mailing.) Catalog No. D-301.44.

Name____________________

Address____________________

City________________State__________

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major Vernon R. Stutts

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby

Editorial Asst.
Amelia Askew

Distribution
T/Sgt. William H. Johnson

CONTENTS

First Flight 2
How Well Can You Remember? 7
The Spin Treatment 8
The First 250 11
Accident Briefs — Transitioning 14
F-101 — Parade of the Centuries 16
Force of Habit 21
In The Beginning 22
Look Out Below 26
Crossfeed 28

VOLUME THIRTEEN **NUMBER THREE**

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

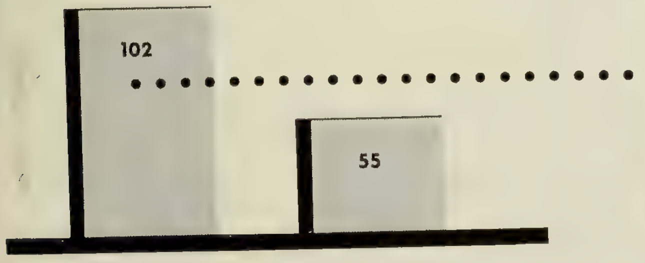
the Transitioning Pilot

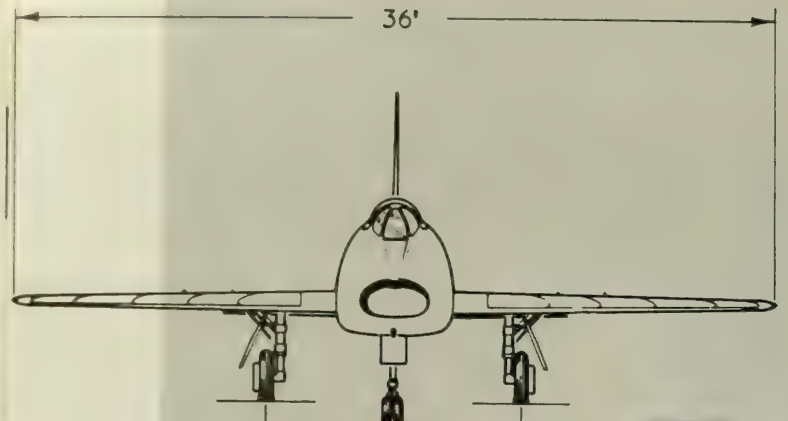
. . . in the accident picture

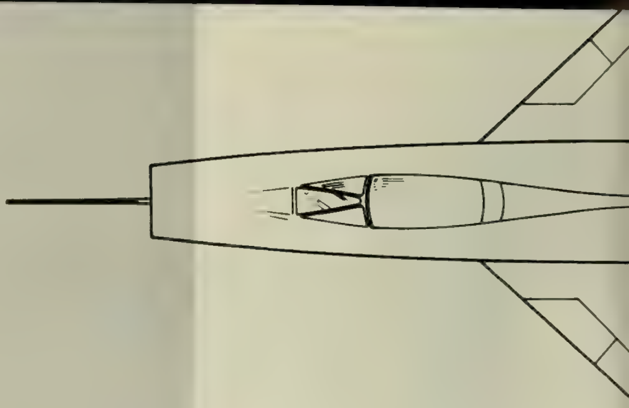
THE SUBJECT of March's contribution to the 1957 aircraft accident prevention program is "Your New Aircraft." It may seem to you old heads that all of this flying safety accentuation is strictly for the "new troops." You may feel that "Oh, that's fine for the new guys but I've been flying in this man's Air Force for 10 years, and that does make a difference."

But let's take a fast look at some cold facts. You, sir, also fit into the accident picture. Consider yourself as a transitioning pilot. A transitioning pilot is any pilot, regardless of total flying time, who flies a different model aircraft. When a pilot checks out in a new or different bird, he is highly vulnerable to having an accident. For example, during the year 1955 in jet fighter accidents, the pilots who had previously acquired some time in a specific model had an accident rate of 55. The transitioning pilots, those checking out in this model for the very first time, had a rate of 102. These accident rates indicate that transition time is a period which requires the utmost attention by all pilots, regardless of experience.

Keep in mind the illustration below when the time comes for you to "Report to the training office, Major, you're scheduled to check out in '86s."







FIRST

Ever imagine yourself as a test pilot for an aircraft manufacturer? The following story was written by a guy who is very much one—Chief Test Pilot for North American Aviation, Inc.—Bob Baker.

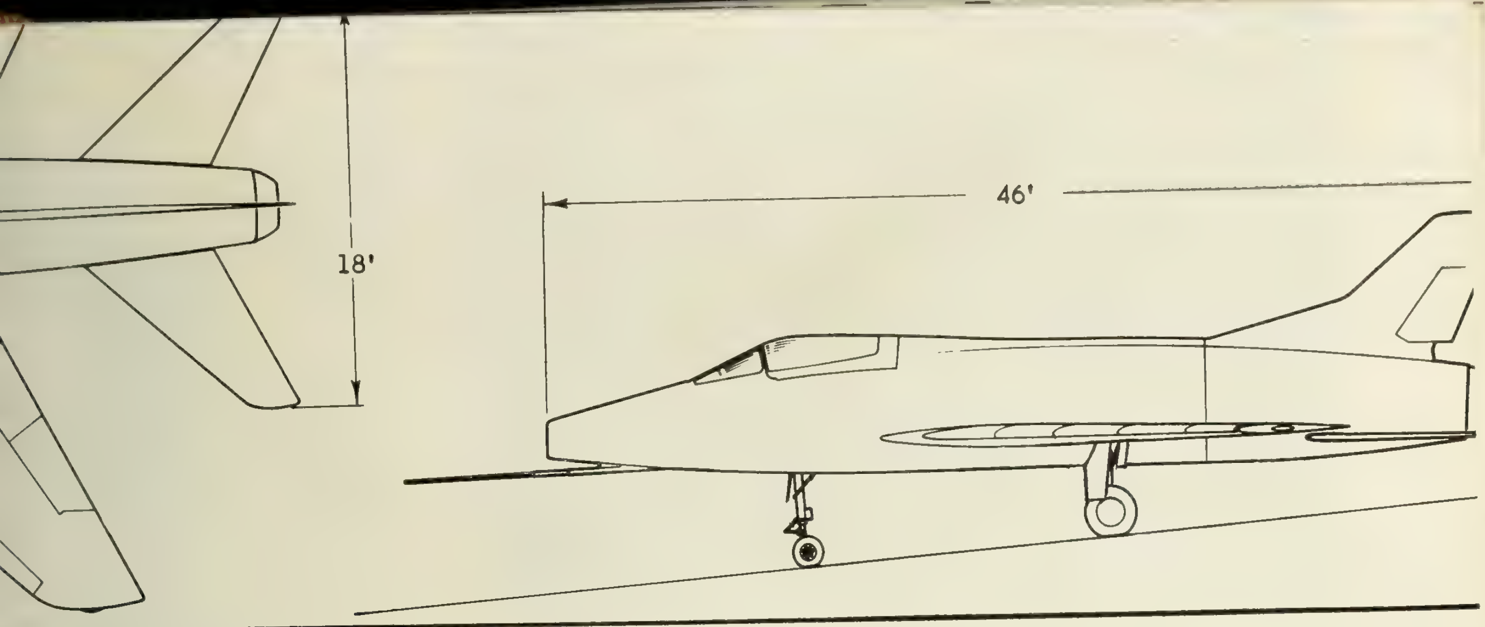
Here he gives you a fictionalized account of a test pilot's preparation for a first flight. However, the article is based on actual test flight incidents in the careers of Bob and other test pilots. The author's background for this article includes an aeronautical engineering degree and more than 6000 hours of flying all types of airplanes. He was the pilot for the first flight of four airplanes.

His advice? Know your airplane. When you think you've got it hacked, go back over it again.

Keep this thought in mind while you read: If you haven't flown a particular bird before, it's just as new to you as if it had just come off the drawing board.

YOU'VE JUST started a new job as an engineering test pilot with a large aircraft company that is currently building first-line fighter airplanes. Before this job, you flew these fighters; you know the thrill of being airborne. Now, with 2000 hours of flying time behind you, more than 1000 hours in jet fighters, you feel well qualified for this new job.

During the first week you go through the flight physical examination again, you meet all the important people and you're assigned locker



FLIGHT

Bob Baker
Chief Engineering Test Pilot
North American Aviation, Inc.

space in the hangar. You get a cockpit check in one of the new aircraft. This airplane has only 50 or 60 hours of flight time on it. Its first flight was only six months ago.

Then, one day the chief engineer asks you if you've seen the latest mock-up. Up to now, you thought you had access to every place in the plant but for this one you find that you need a special pass. You're ushered through a well-guarded door while the guard gives you a quizzical look when you are identified as a test pilot.

You recognize the form that takes up much of the room, as that of an airplane but the size and lines are brand new. You, of course, haven't seen this shape fly, but you wonder at some of the innovations. You're awed by the size of the air intake and the large amount of space left for the engine. In and around the intake duct are strange mechanisms. In contrast to the large space allotted for the engine is the cockpit, looking small on the huge airframe.

The chief engineer tells you how fast the airplane will go, how high it will climb, the speed at which it will land and the thrust of the engine that will drive it, in figures of new size and meaning. The fuel capacity rivals that of a bomber, but when you hear the fuel consumption rate, you know you're still in the fighter business.

You start to consider the problems that will be presented by a brand new airplane. Then you relax because you realize that you've just joined the company and the airplane in front of you will not fly for 18 months or two years. There will be time enough then to worry about the complexities of this strange bird.

You go to work at your job, pushing projects against time. Competition is strong in the aircraft business. Flight test is the last item before the airplane is delivered so that time consumed by shortages or other delays during design and construction, results in tests being started after they were scheduled to be finished. You gain experience as you are faced with instances of afterburner rings blowing out, fuel starvation with modified tanks, unexpected buffeting, and fuel tanks hitting the pitot boom during jettison tests. Improvements in production airplanes create a continuing need for flight testing.

Then, there is excitement as a new airplane is towed off the final assembly line in the special experimental department. Your calendar tells you that 20 months have slipped by before you realized it. And you reflect that neither you nor the other pilots have put much time into getting acquainted with this airplane; the projects have kept you busy. You wonder how the project pilot can possibly learn all he needs to know before he flies the new airplane. But when this latest addition to the company's fighter line comes out of the shop, it goes into the flight test hangar where it will remain for another two months for instrumentation and ground testing.

Something else has happened during the past 20 months. You've changed from a fledgling test pilot to an experienced one. Still, you are surprised when you are assigned as the project pilot to fly the new airplane for the first time. This bird that appeared so strange to you 20 months ago, suddenly takes on a different aspect.

Now, you're faced with a job more important than any you've had to date—to learn this airplane inside out. The first time that you sit in the cockpit you find many familiar things. The human factors group had checked with you and other pilots during mock-up and now you find that the suggestions have been incorporated in the cockpit.

The first day the airplane is in the flight test hangar, the flight test project engineer contacts you and gives you a listing of all the major component parts. You're scheduled to study one-half day on each major section of the airplane and two days on the more complicated sections. In addition, you will use simulators, visit special mock-ups and check field system tests. You are eager to get started and at first wonder why they don't schedule you for a full day of study instead of a half day. You find that the fuel system mock-up is a full-sized boiler-plate version of the fuel system, with all the pumps, lines and tanks exactly as they are in the air-

Memorize every item. Once you are airborne, you will have to analyze problems for yourself.

plane. Before the first week is out, you're so saturated with new information that you are grateful for the half-day schedule.

Your instruction begins with general arrangement of the airplane. The importance of this information strikes you when you realize that after you are airborne you will not have anyone to explain these things to you. If something buffets, breaks, gets plugged, bends the wrong way, or jams, you will have to analyze the problem yourself.

You memorize each item that you learn in order to become completely familiar with the airplane. You note that the expansion turbine for the cockpit air conditioning is located just aft of the back rest and that there is one on each side of the airplane. This is a dual system so that when one fails you will still have pressurization and cooling at high speed and altitude.

You note that the landing gear folds partly into the wing and partly into the fuselage. This is different from other airplanes you've been flying and it makes you wonder what aerodynamic influence the gear will have during retraction after takeoff.

Twenty months ago, nearly all airplanes had trailing edge control surfaces. Only a few of the newer fighters had all-flying horizontal tails. But this airplane has no trailing edge control surfaces. The all-movable horizontal stabilizer and the all-movable vertical stabilizer give the control required at high Mach number. The ailerons have been eliminated and you no longer have to worry about aileron reversal speeds. You are, however, faced with a new concern. What are the characteristics of the new spoilers and how do you use the special controls to put them "in" or "out" if they are too effective or not effective enough?

Weeks go by, and you become fully acquainted with the longitudinal, directional and lateral control systems. The boundary layer control and the flap system are items that you know about from prototype versions on more familiar aircraft. The inlet duct system requires two days of review because the operation is so new to you. The slats and speed brakes are conventional but there are some changes in design and mounting.

It is difficult to get into the actual airplane with the instrumentation engineers working full time around the clock, so you visit the cockpit mockup several times. Gradually, you are getting to know the physical characteristics of the airplane. In addition, however, you must know what is expected of it. You go over the wind tunnel results with the aerodynamicist and you discuss inertia coupling, a phenomenon only recently new to pilots. Although you don't plan to spin the airplane, you go over the spin characteristics thoroughly. You learn the different flight characteristics that result from spoilers instead of ailerons.

Other preparation requirements are checking reports and flying as many airplanes with prototype controls as are available. Also, you take a trip out to the engine test stand to get acquainted with the instrument indications. You find that the exhaust gas temperature no longer is a self-generating instrument but instead operates from ac generator power. You study the fuel system operation and try to get a good mental picture of the operation of the new electrical and hydraulic systems. You cycle the landing gear and watch the landing gear tests as the gear is loaded to simulate air loads.

Sometimes when the information is being pumped into you, you might feel like a balloon being inflated, and even though you may think you are close to the saturation point, there always seems to be room for more. You memorize the restrictions and limitations because there'll be no time for questions in a pinch. And you fly the flight simulator as fast as the mathematicians can change the electronic circuits.

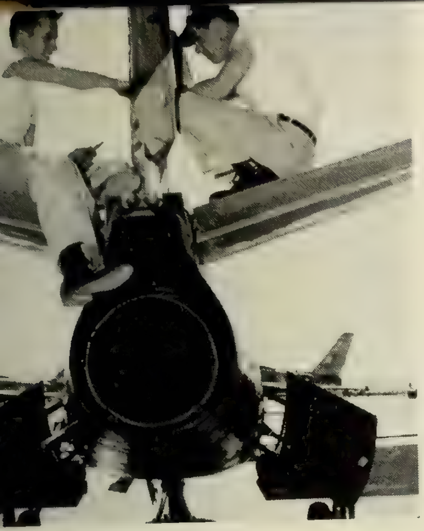
In addition to the regular airplane instrumentation you also must be familiar with the flight test instrumentation. Data analysis is important since you have just so much recording time available and you'll have to know (when you encounter a phenomenon) whether or not you have the instrumentation to record it. It would be a waste of time to repeat a run for a phenomenon that could not be recorded.

You read the Flight Handbook for the new airplane from cover to cover and find yourself more in the position of an associate editor than a pilot. You and the flight test project engineer have the only overall picture of the entire airplane, since others on the project have devoted their time to specific sections.

Your schooling is nearing completion and you have your first examination:

- If the ac failure warning light comes on, what do you do?
- If the No. 1 hydraulic system pressure drops below 1000 psi, what can you expect?

Use special mock-ups and field systems tests.



Will you know if their job has been done right?

- If you have a flameout, what is the emergency landing procedure?

You're going to have to know the answer to any problem that may present itself up there.

Then, after completing the exam, *you* have a question. The hydraulic valves for the flaps look too small for the job. You ask the hydraulic project engineer about the valve and learn that five pounds of weight was saved by having a single-action valve. When electrical power is on this valve, it is in the open position and the flaps are down. When electrical power is interrupted, the valve raises the flaps. No one had realized that on an emergency landing when you turn the battery off just before coming in, the flaps will come up and spill you short of the runway. There is no time to change the valve before the first flight, so emergency landings will have to be made flaps up.

You go over every part of the airplane and then you go over it again. When you release the brakes, a lot will depend on what you know.

Taxi tests are a problem on the new airplane. This same problem has been plaguing first flights for the past several years. The weight of the airplane and its takeoff and landing speeds are not compatible with last year's tires. New tires have been designed but they have not yet arrived.

Standard procedure is to determine the ground handling characteristics on taxi tests by making turns at low speeds, figure eights, and complete reversals. On higher-speed runs, you watch for shimmy, resulting from the nosewheel steering system. You remember some taxi tests that you observed several years ago when the nosewheel would not caster and tests were held up for several days to change the design. You hope that nothing like that happens to delay these tests.

After the high-speed taxi tests, normal procedure is to make lift-offs a few feet from the ground. This was all right with straight wings, but with highly swept wings where the wing flow characteristics break down to make high drag at minimum speeds, this might not work.

Again you remember an incident where a research airplane had just become airborne on its first flight and fuel starvation caused an immediate landing. At that time, an old-time pilot remarked, "This problem of fuel starvation is one we had 20 years ago. Don't tell me they still have it!"

However, it is decided that it is safer to fly than to hop off the ground and return immediately. Not only the aerodynamic characteristics of a high-speed fighter but also the landing gear and tire conditions help to shape this decision.

The date of the first flight arrives. You feel quite confident that you know the airplane systems and all of the predicted wind tunnel characteristics. If everything goes as designed and predicted, you'll have no trouble.

As final preparations are made, you think of some of the things that could go wrong. You remember the jet fighter that had looked so sleek as a result of a special process that had given it the smoothest skin you'd ever seen. On the first flight, the pilot had experienced a flameout with the experimental engine used in the airplane. The pilot had made a successful landing on Rogers Dry Lake. Then, in the next series of flights, the pilot had found that the stall characteristics resulted in an abrupt half snap roll without warning. How well had the wind tunnel data predicted the minimum speeds for this bird?

The control systems in the airplane you will fly should be a big improvement over previous systems with which you have had experience. You remember that the same airplane that had the nosewheel that wouldn't caster, had one of the first irreversible control systems in it. The first time the airplane had tried to exceed 250 knots, a pitching oscillation was encountered. The pilot had released the stick to determine if the oscillation was caused by the aerodynamics of the airplane or a pilot-induced feed-back in the control system, and the oscillations stopped. The lessons learned at that time had been digested and trouble of this type should not occur in your airplane.

Ten years ago, all first flights were made without retraction landing gear but the speed of present-day fighters has changed that. You recall the fighter on which the landing gear came up and jammed on landing? There were cases where landing gear doors failed to open to receive the gear, cases where the landing gear would not come down, and one case where the nose gear stuck in the retracted position and came down after the main gear touched the runway to provide a perfect landing.

In another case, a pilot had completed the taxi test the evening before the first flight and no one had touched the airplane during the night — he thought. Immediately after takeoff, the cockpit filled up with hot air directly from the engine compressor without going through the expansion cooling turbine. Fortunately, the pilot had been able to open the canopy in flight, but after a fast circle of the field, his shoes were too hot to touch.

Wind tunnel tests of the entire machine are sometimes done for positive checks on theory.

Everything is ready . . . the ramp looks more like a movie studio than an aircraft engineering project. You double check with your crew chief and tell him again, "Don't let me out of here unless everything in the cockpit is in the right position, the speed brakes are up, the flaps are set for takeoff and the controls are in trim."

As you push the engine starter button, all the confusion outside the airplane is lost. You are concentrating on a job. RPM comes up, throttle is brought around to idle, fuel flow is 750 pounds per hour, engine RPM is still increasing from the starter force and exhaust gas temperature starts to rise. The engine comes up to idle speed and the starter cuts out.

You signal the crew chief to disconnect the external power and move the starter unit. As you taxi out to the end of the runway with your chase plane in formation, it seems like just a routine procedure. A photo airplane has already taken off. You line up at the end of the runway facing east. Fifteen thousand feet of runway and several miles of dry lake bed lie in front of you.

The taxi tests have taken some of the novelty out of the cockpit procedure. The photo chase plane reports on base leg and the tower gives clearance for takeoff. You glance at your controls and indicators:

Military power . . . RPM . . . exhaust gas temperature . . . oil pressure . . . loadmeters . . . hydraulic pressure. Okay, release brakes . . . afterburner ignition. The 1000-foot marker goes by, the 2000-foot marker. Airspeed passes 150 knots at the 3000-foot marker. You lift the nosewheel. You're actually airborne and a new airplane is in flight.

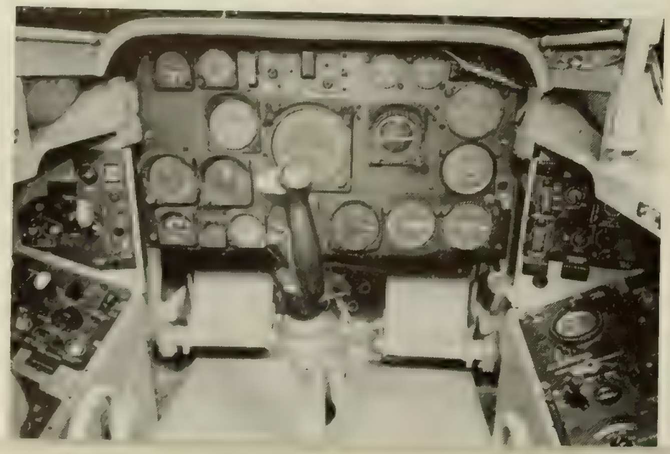
At a thousand feet you have to come out of afterburner so as not to exceed the gear-down limitation speed. At 3000 feet you have good ground clearance but you have not moved the controls unnecessarily.

You pull the landing gear handle up and feel the gear sock home. Then you let the nose drop just a hair, to pick up speed and continue your climb. At 10,000 feet, you start a slow turn to keep the dry lake in sight. At 400 knots (that was close to top speed just a few years ago) you are just hitting the climb schedule for reduced power climb. Then you light the afterburner. Immediately you pull away from your chase plane.

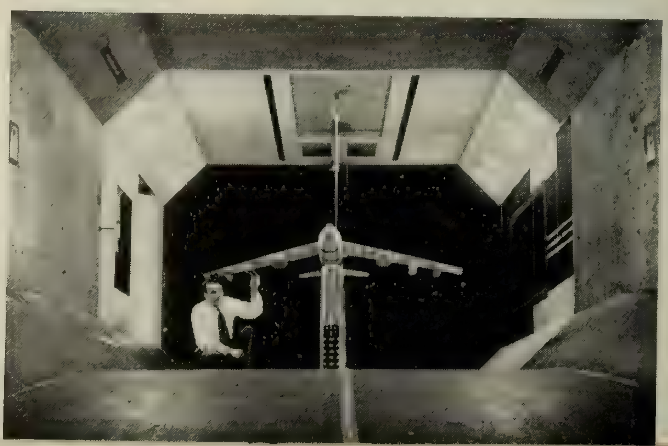
You remember your careful preparation for this flight and feel the confidence that comes from knowing your airplane down to the last rivet. As you watch your airspeed and Mach indicator you reflect that although the '86s were okay in Korea, *this* is the airplane they'll need if more trouble comes. Suddenly you realize that you are writing a new chapter to the history of flight. ▲

Simulators provide familiarity with controls.

The other half of your team. Work with him.

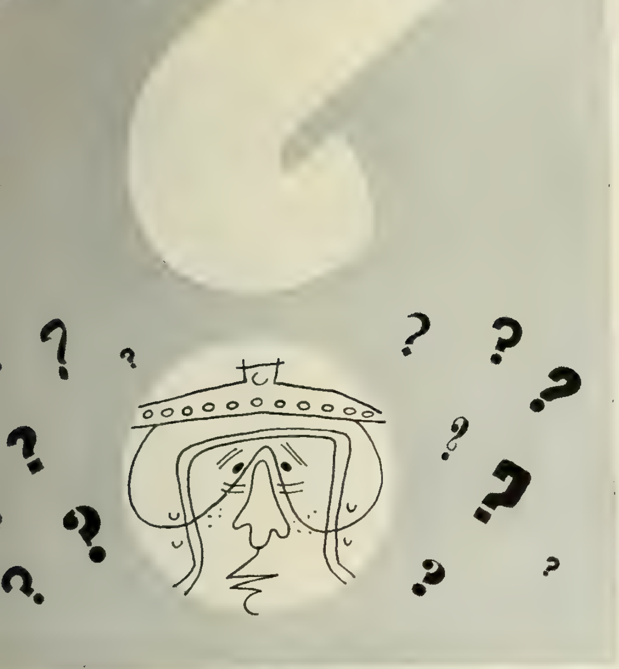


When you think you've learned it thoroughly, go over it again.



Each airplane has its own phenomena. Learn what applies to yours.

How Well Can
ou Remember?



January (Supervision)

1. About what percentage of all aircraft accidents involve a supervisor who had neglected to exercise his assigned responsibility?
   (a) 11.
   (b) 17.
   (c) 26.

2. There is now an entirely new system of weather reporting designed to give you a current observation every:
   (a) 20 minutes.
   (b) 30 minutes.
   (c) 60 minutes.

3. If you must engage the landing barrier in the F-100, the dive brake must be:
   (a) retracted.
   (b) extended.
   (c) either.

4. The minimum speed (low speed cutoff point) for successfully engaging the barrier in the F-100 is:
   (a) 11-17 kts.
   (b) 23-28 kts.
   (c) 28-33 kts.

5. The B-58 (Hustler) is powered by:
   (a) two J-79 engines.
   (b) four J-79 engines.
   (c) six J-79 engines.

February (New Pilot)

6. Almost half of all major jet fighter accidents are experienced by pilots with less than .... (rated) jet hours.
   (a) 150.
   (b) 200.
   (c) 250.

7. Pilots under 25 years of age represent 11 per cent of the total Air Force pilot pool and account for .... per cent of all pilot error fatalities.
   (a) 15.
   (b) 30.
   (c) 45.

8. Percentage-wise, what aircraft has the worst record for inadvertent gear-up landings?
   (a) T-33A.
   (b) F-86D.
   (c) F-84F.

9. Two jet fighters are on a head-on collision course, with a closing speed of 840 knots. With 20/20 vision, the pilots can first detect each other when they are approximately .... seconds apart.
   (a) 30.
   (b) 60.
   (c) 90.

10. Pilot-to-Forecaster Stations are available on UHF Channel 13. Facilities are listed in the RFC under:
   (a) centerspread.
   (b) remarks.
   (c) Airdrome directory information.

March (Your New Aircraft)

11. During 1955, in jet fighter accidents, pilots who had previous time in the aircraft had an accident rate of 55. Transitioning pilots had a rate of ....
   (a) 64.
   (b) 77.
   (c) 102.

12. During spin recovery in the F-100C or D, the ailerons must be:
   (a) neutral.
   (b) full against the spin.
   (c) full with the spin.

13. During the transitioning to a different aircraft, the known "critical flying period" is the first ....
   (a) 100 hours.
   (b) 200 hours.
   (c) 250 hours.

14. The F-101A is powered by:
   (a) one J-57 engine.
   (b) two J-57 engines.
   (c) two J-47 engines.

15. During aircraft testing and development, which phase is conducted by the Air Proving Ground Command?
   (a) Phase V.
   (b) Phase VI.
   (c) Phase VII.

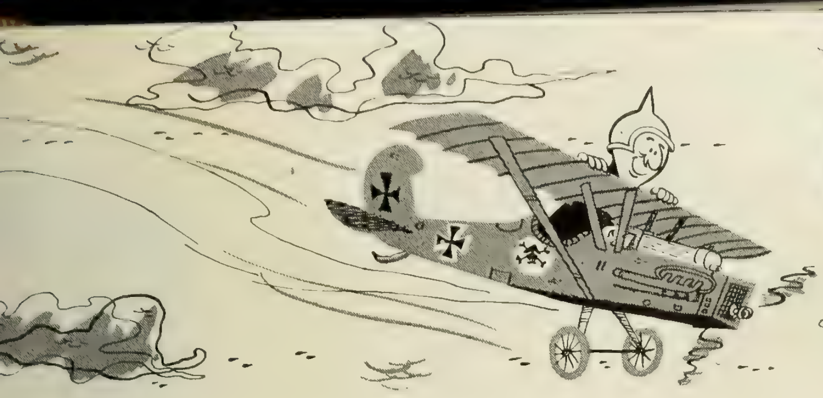
ANSWERS

1. (b)	6. (a)	11. (c)
2. (a)	7. (b)	12. (c)
3. (a)	8. (b)	13. (c)
4. (c)	9. (a)	14. (b)
5. (b)	10. (b)	15. (c)

the Spi

THERE IS only one way to treat spins in the bird of today. . . . Don't! Oh, I can hear it now — "What do you mean?—People spin these birds all the time." And this statement I can't fight, but for the information of all who care to listen, hear this: Guys are spinning in, too. And with our newer fighters, this situation isn't going to improve at all.

Spins today are a different breed of cat than in years gone by. The giant iron monsters that carry the tab "fighter" weigh in at between 20,000 to 50,000 pounds and go like the dickens. It used to be "stick back, opposite rudder, neutralize, stick forward. Bang, bang, bang, like that," and you flew out neat as anything. This may be one of the reasons a few troops spin in. That bag of lead you're driving today gets to going in one direction and it takes some doing and some time to stop it. When you kick opposite rudder, she doesn't obligingly respond — RIGHT NOW. Understandably, this can panic a troop more than somewhat. The F-84F for example will take another turn or two before rotation stops.



Treatment

There was a time when a single procedure for spin recoveries worked for all kinds of airplanes. That's by the boards. Any spin nowadays is an invitation to trouble. Your best solution is—DON'T.

Don't start slapping the controls all over the area, in a last minute desperation panic.

Ironically enough, after the pilot has ejected from his spinning bird, often the aircraft recovers by itself. This, of course, is most embarrassing but it does substantiate the possibility that the troops are getting impatient in the recovery response. Now I'll be the last one to criticize a bailout of an uncontrollable bird. But, altitude permitting, give 'er a chance.

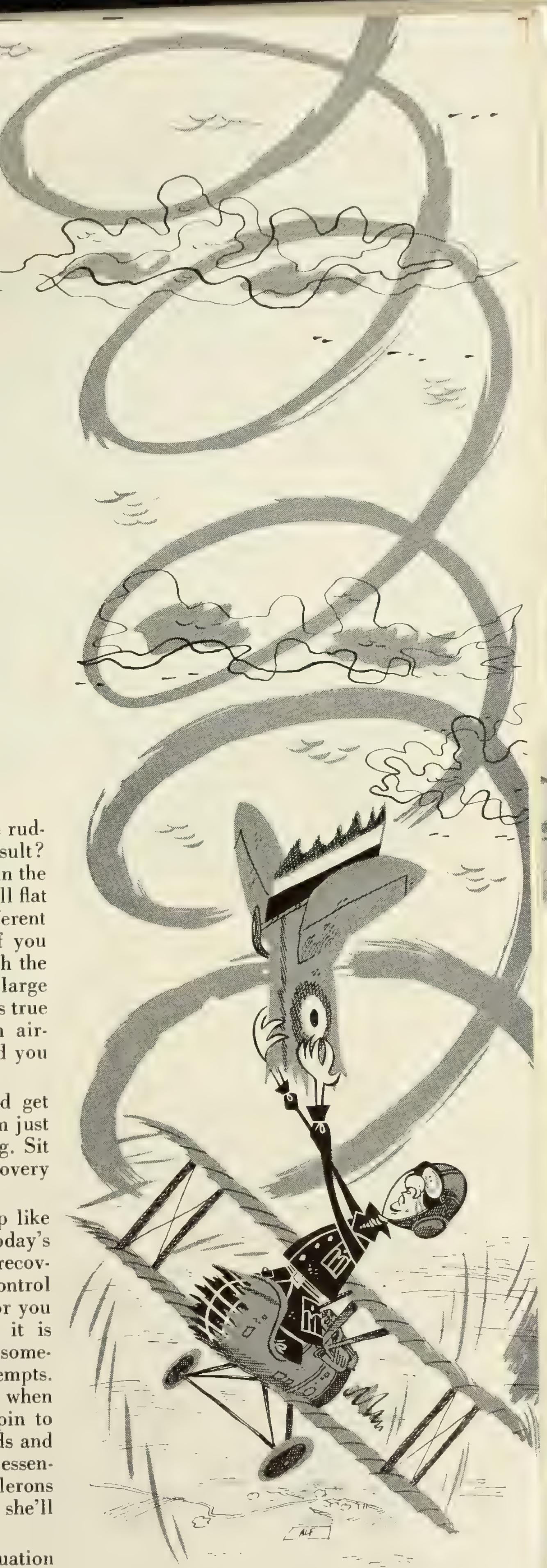
It also should be remembered that spin recovery procedures vary with different aircraft. Knowing the specific procedures for your bird is a must, and they are probably different from the old standard recovery techniques of yesteryear.

A review of accidents wherein the causes read, "Unable to recover from spin," indicates that many pilots do not know the exact recovery techniques for their particular aircraft. There are a couple of valid reasons for this. One, spins are not practiced anymore and, two, we have all been indoctrinated with the old NACA standard spin recovery procedures, and we use them. The net result is that a fellow flips into an inadvertent spin. It is the first one he has ever been in with this airplane and he automatically gives her the ailerons neutral, stick back, opposite rudder, neutralize rudder, pop the stick forward. Result? . . . Nothing. Use this procedure in the F-100D, for example, and you will flat run out of air. The '100 has different spin recovery procedures and if you do not hold the ailerons full with the spin you are going to make large fence post holes. The same idea is true with the '84F and others. Each aircraft has its own procedures and you have to know them.

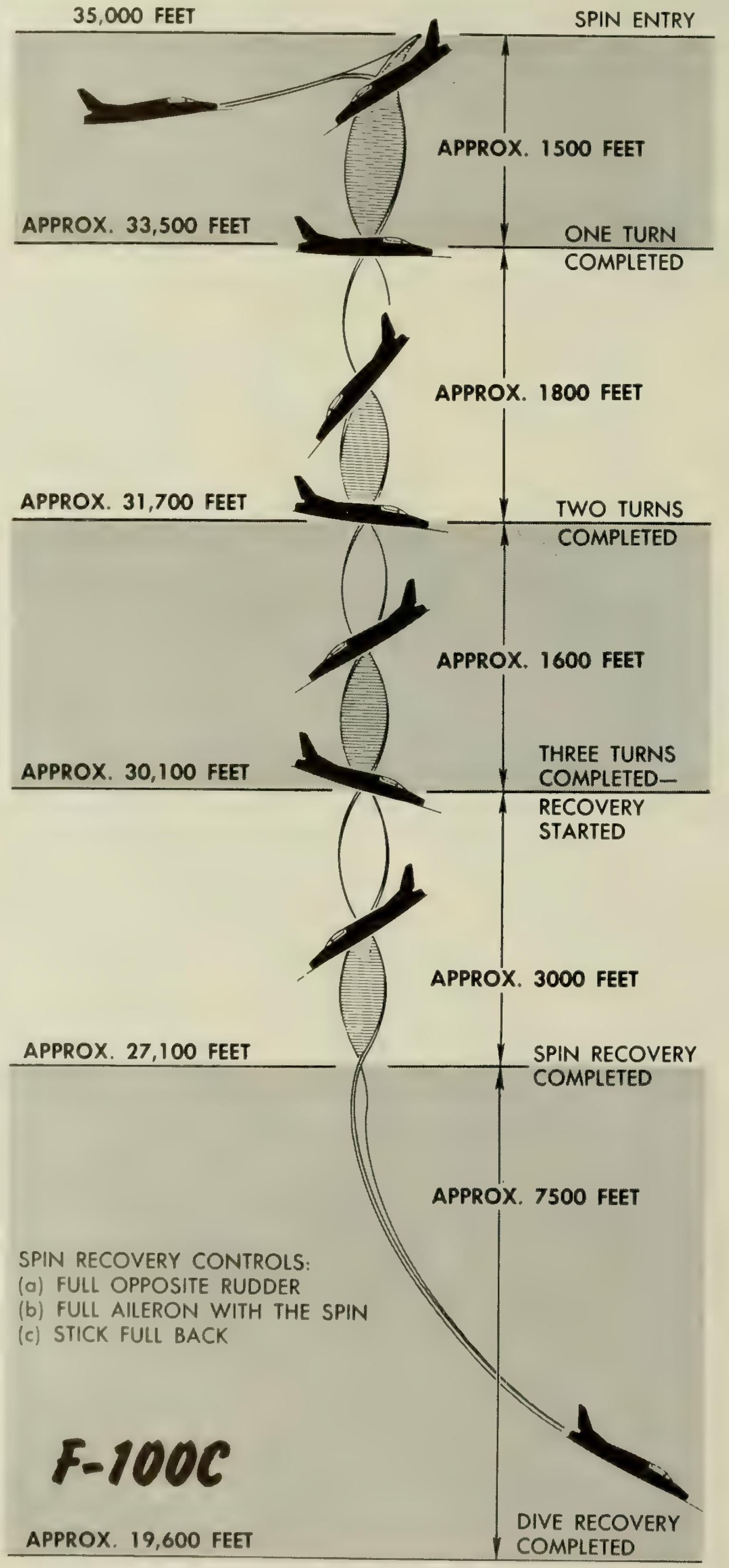
Study the flight test data and get the facts down pat. Practice them just like you would practice ejecting. Sit in a chair and go over the recovery techniques again and again.

An old F-100 head sums it up like this: "You must realize that today's bird has an 'unstandard' spin recovery procedure. Also, every control must be manipulated correctly or you are out of business. Actually, it is better to do nothing than to do something wrong during recovery attempts. I always advise the troops that when they flip into an inadvertent spin to just do nothing for a few seconds and get yourself oriented. This is essential because if you put ailerons against the spin, for example, she'll just keep on winding up.

"You can't aggravate the situation by not doing something for the first second. Gad, the bird is stalled out.



It was bad enough in Spads of the Escadrille.



dead and has fallen off a wing. . . . Things are about as loused up as they can get. Just get yourself oriented, then perform the correct spin recovery movements as published."

Next to knowing the correct spin recovery techniques for your particular bird, you can best stay out of trouble if you . . . DON'T SPIN in the first place.

As far as I know there is no requirement for the spin maneuver. The Escadrille, flying Spads Mark IV, used this crazy maneuver to elude the Fokker but even this was not too highly recommended. Ol' Jerry would just follow you down and when you pulled out, he would nail you.

Aside from the lack of requirement, in the latest Century Series aircraft there is even more to substantiate the "Don't Spin" concept. You may not be able to recover. Now I'm really on thin ice and everybody from the aircraft companies to the aviation Kaydet Corps will probably take the pipe. But I stand by my guns.

Theoretically, all birds get the spin test treatment. But these test aircraft are (1) being flown by fellows who really know their craft and (2) they have everything from wingtip spin chutes to wingtip rockets to assist the recovery.

Take Convair and the F-102, for example. They're going to conduct a spin test program but will still probably come up with the same Dash One recommendation which they now have, namely, "Do Not Spin." We have a real good fighter in the '102. It does everything well and really scoots. So it has rather weird spin characteristics—so who cares?

The spin tests conducted on everything from the T-33 through the F-100 indicate rather favorable spin recovery characteristics, if you use the proper procedures. But even with these, why get into a spin?

With the amount of power available there is no need to get down to stalling airspeeds. If you insist on letting your airspeed drop out of sight while flying upside down and sideways, you can end up in an inadvertent spin. So when you're practicing acrobatics and such, play it cool. Fly some 20 knots plus above the stall regardless of maneuver.

Needless to say, if you don't get into a spin you won't have any spin recovery problems. ▲

the first 250

Colonel Paul P. Douglas, Jr.
Chief, Investigation & Safety
Engineering Div. D/FSR

Those dry, old statistics say, "A large percentage of aircraft accidents occur during the transitioning period and that the first 250 hours are the roughest."

WHAT HAPPENS when a new pilot comes aboard, or when a unit transitions to new equipment? In either case the problems are similar and may be solved by applying the same basic principles.

All flights, other than actual operational missions and engineering test flights, fall into the category of training flights. Let's take a look at some of the problems of training.

Training is accomplished by accumulating experience. And it is essential that certain phases of this training be properly supervised.

Statistics show that the first 250 rated flying hours make up the most critical flying period in any pilot's career. This holds true whether the pilot be assigned to a bomber, fighter or cargo outfit. However, bomber and transport pilots do receive an extended "apprenticeship" as student pilots and copilots before they assume first pilot duties. In jet fighters and in new jet bomber aircraft, an identical apprenticeship is impossible. These pilots must rely greatly on their own personal knowledge, capability and experience. In any case the course of training is directed towards building the "man and machine" into a practicable and useful weapon.

We can start his academic training by handing him a flight handbook and a questionnaire. He attends a mobile training unit, if available, and is briefed on pertinent regulations and SOPs regarding local rules and procedures. His aircraft knowledge is checked by the standardization board and the unit flying safety officer should review with him the accidents involving this type of aircraft.

Then follows a period of cockpit checks, taxi training, simulator rides (if available) and his first flight in the unit aircraft. Some organizations require the pilot to demonstrate his capabilities as an instrument pilot prior to soloing.

The pilot becomes thoroughly familiar with formation flying, acrobatics, simulated combat, navigational flying with strange field operations, gunnery, bombing and interception procedures. These include both day and night operations, not only from the purely academic approach but specifically as they must be applied to accomplish the mission of the unit.

During the period that the pilot is receiving his checkout towards becoming combat-ready, his flying is supervised very closely, especially during takeoffs and landings. Then, as he proves his adeptness, this supervision is lessened gradually until he is pretty much on his own. No longer is there an "old timer" standing by to watch every move that he makes. Also during this period, our pilot will probably advance beyond the 150-hour mark but he will still be in the "known critical flying period."

It is understandable that unit operational requirements make it necessary to lessen personal supervision over each new pilot as soon as practicable, and also that commitments may call for a new pilot to be assigned to a mission sooner than was anticipated. But, whatever the circumstances, we must satisfy ourselves that the pilot is at least capable of

The academic approach is fine, but the real test is the ability to apply it to the new bird.

handling emergencies. Here is a sample of what can happen:

The pilot of a B-57 had a total of 1748 flying hours, 81 jet hours, of which 18 were flown in this type of aircraft. While cruising at 39,000 feet on a navigation and radar bomb scoring training flight, the pilot observed a fuel flow fluctuation on the left engine which increased in magnitude. He did not correlate the fuel fluctuation with engine RPM, exhaust gas temperature and aircraft control characteristics to determine if an emergency did exist, but instead switched the left engine emergency fuel control to TAKEOFF position. The engine overheat warning light came ON, engine RPM increased to 120 per cent and the navigator reported flames from the left engine. The pilot then stopcocked the left throttle and advanced the right throttle but received only an indication of 50 per cent RPM.

The right throttle also was stopcocked. The interphone failed and he lost voice communications with the navigator. Excess electrical circuits were not turned OFF and the battery was discharged.

After descending to approximately 17,000 feet, three airstarts were attempted, but without success. Both crewmembers abandoned the aircraft.

Let's consider the factors in this accident. The emergency procedures used by the pilot were not according to instructions in the handbook or in the checklist. As a result, the left engine failed after being subjected to overspeed and overheat conditions. There was no evidence of left engine malfunction that could have contributed to the reported fuel fluctuation. The magnitude of fuel flow fluctuation should have resulted in engine surge or inflight yaw. These conditions were not noted by the pilot. The right engine failed when the fuel shutoff valve was inadvertently closed.

We can hope (and assume) that a number of our fighter problems will be alleviated by the introduction of TF versions of each of our operational fighter aircraft. Meanwhile, here's another accident report which indicates that like problems exist in all aircraft. This one involves a pilot with limited experience.

This pilot had a total of 449 flying hours, 146 jet hours, 71 of which were in F-86F aircraft. As he was preparing to enter the traffic pattern at 2000 feet, with the engine operatng on the main fuel control system, e noticed that engine RPM began to fluctuate, then drop. Tailpipe temperature also began to drop. The pilot immediately set up a pattern for an emergency landing at a nearby civil airfield, then attempted several airstarts using the main fuel control system. During the fourth attempt, the aircraft was crash-landed in a field one mile short of the airfield. The pilot received major injury.

All right, let's see what might have prevented this accident.

First, the pilot made no attempt to start the engine using the emergency fuel system as outlined in the flight handbook. Actually, had he alerted the emergency fuel system immediately (since a malfunction was indicated by the fluctuating RPM), the subsequent flameout probably would not have occurred.

Interrogation of the pilot disclosed that he did *not* fully understand the operation of the emergency fuel system. His F-86F questionnaire, however, completed only two months earlier, *did* contain satisfactory answers relative to this item.

Next, the pilot could probably have landed safely at the airfield he selected, had he followed prescribed flameout landing procedures. He had not retracted the speed brakes or established the prescribed glide speed. As a result, the glide distance was shortened considerably.

Other instructions regarding belly landing emergencies which were not followed, included these:

- The wing flaps were not lowered.
- The battery and main fuel shutoff switches were not turned off.
- The canopy was not jettisoned.
- The shoulder harness was not locked.

This pilot, with his 146 jet hours, was still in the "peak accident potential area" although he is considered a fully qualified F-86F driver.

Three other pilots of the squadron, with experience comparable to his, were questioned and not one could correctly relate emergency procedures. Each stated that he had read the handbook and had participated in periodic discussions with flight leaders concerning these procedures, but still didn't know them.

Both the squadron commander and the operations officer were aware of the need for training pilots in emergency procedures and for continued emphasis on knowledge thereof, during briefings. Yet, there was no published schedule to insure this training—and therein lies our problem.

How can we assure ourselves that all pilots do understand the aircraft they are assigned to fly?

How can we be sure that pilots understand the operation of primary and auxiliary aircraft systems so that step-by-step emergency procedures actually mean something, and are not just items for recitation or for listing on a questionnaire?

Flight handbooks are designed to provide pilots with the latest information on the operation of an aircraft and its systems, and there is no other procedure in existence to parallel this means. Standing Operating Procedures (SOPs) are fine for their intended purposes—that of providing pilots with specific data relative to aircraft operating procedures as used by units in accomplishing a mission—but they do not give intimate details relative to operation of a specific aircraft. These must be known.

The Transition Indoctrination Team, provided by the Air Proving Ground Command, should be included in the program after the crews have accumulated approximately 10 hours of flying time in unit aircraft.

While there still remains no magic word for the problems associated with transitioning from one type of aircraft to another, there are many things that can be done to assure that all available knowledge and training facilities have been used. This can be done only through the use of thorough planning for the task to be done. To assure that your planning is complete, establish a comprehensive program adapted to your needs. Only you can determine the complete requirements but here is a sample that is tried and true. But the success of it, and yours, depends entirely upon how well it is carried through. ▲

Academic Training

- Lectures on the aircraft, its systems and operation.
- Flying characteristics.
- Accident review and emergency procedures.
- The Dash-One.
- Completing a questionnaire.
- Squadron and higher headquarters SOPs and regulations.
- Physiological training.
- Mobile training unit.
- Standardization board check.

Simulator Training

- Familiarization.
- Normal procedures.
- Emergency procedures.

Transition Training

- Demonstrate instrument proficiency.
- Visual inspection of the aircraft and forms.
- Cockpit familiarization.
- Start, taxi, shutdown.
- Mission briefing.
- Solo.
- Complete detailed transition program.
- Standardization flight check.

Tactical Training

- Formation, acrobatics, simulated combat.
- Navigation, strange field landings.
- Rocketry and/or gunnery.
- Intercept procedures.
- Bombing.
- Reconnaissance and photography.
- Cargo and troop airlift procedures.
- Standardization board interview.

Despite the chatter you hear in the ready room, this bird does not fly "just like" another one. Every one has its own set of idiosyncrasies. Here's the proof.

PREVENTABLE human error accidents which occur as a direct result of inadequate experience continue as one of the most prevalent types. Typical of this is the accident involving a student who was to participate in a four-ship formation flight. During takeoff everything appeared normal. On climbout the pilot became concerned over what he considered erroneous airspeed readings.

A dual ship in the area was asked to check with him and fly his wing down the final approach for landing. This was done with the dual ship breaking away just before the touchdown point was reached. At this time the airspeed indication was 130 knots. The student pilot landed with approximately 5000 feet of runway remaining, but because of faulty braking techniques, he didn't stop the aircraft. The arresting barrier was contacted but because the student hadn't remembered to retract the dive brakes, the barrier did not engage. The nose gear collapsed and the aircraft was damaged considerably.

Fortunately, the student was not injured, although—as in other flights—his shoulder harness was not locked.

BRIEF STORIES DEALING WITH

A post-accident check indicated no malfunction of the airspeed indicator. The accident (charged to pilot error) is wholly explainable by the fact that the pilot had not yet learned his aircraft procedures.

★

AN F-86A pilot with more than 2300 hours, 28 of which were in this type of aircraft, was on a night checkout. He was briefed about high winds and the unusual pattern (3200 feet above the ground). He made the initial approach at 4000 feet, at 200-230 knots. Mild pitch was observed and downwind held in apparent compliance with briefed pattern. The turn onto final was somewhat low in comparison to high initial. Final approach appeared flat and slow and abrupt drop was noticed as aircraft seemed to stall and drop in. The aircraft landed short, colliding with a blast fence. The board concluded that the pilot had failed to compensate for pattern altitude and the 15 to 20 knot wind.

★

A FLIGHT of two F-100Cs took off on a routine day transition mission. The transitioning pilot had only 11 hours in the bird, so far. With his instructor he climbed to 45,000 feet for the acrobatics which he was scheduled to perform and when that phase was finished, the two planes dropped down for landing. The first approach was too fast and the pilot was told to go around.

On the second approach, everything looked and felt normal to the pilot so the landing was made. Touchdown

was made at or near 180 knots. He popped his drag chute and felt normal deceleration, until the pin that holds it sheared. This happened about 4000 feet from the end of the 10,000-foot runway. There was a vigorous application of brakes, and both tires blew out—the left one first.

The F-100C hit the crash barrier but continued to roll onto the overrun where the nose tire blew and the nose gear sheared.

There were several causes for this accident.

The pilot had deployed his drag chute at or above 180 knots and immediately failed the shear pin. (It is designed to fail at 180 knots or above.) Following this, he used improper braking technique which blew out the tires. This was further complicated by the fact that the nose strut trunnion pin sheared, because of a cracked condition from a previous hard landing or a flaw in the material.

Why did he land so fast? The pilot thought he was about right. But then, normally he wears glasses. Without them, he sees 20/40, and can not pass the depth perception test. With them, he's okay, even as you and I.

But here is the thought for today: Although this pilot had a total of over 2000 hours plus the 11 hours experience in this type of bird, these 11 hours had been stretched over a 90-day period.

★

THIS ONE was in the F-86F . . . and it was to be his first ride. So far, he had been able to pick up some 1800 pilot hours, a few in jets, but none in the '86.

SH

ACCIDENTS DURING TRANSITION

ENT

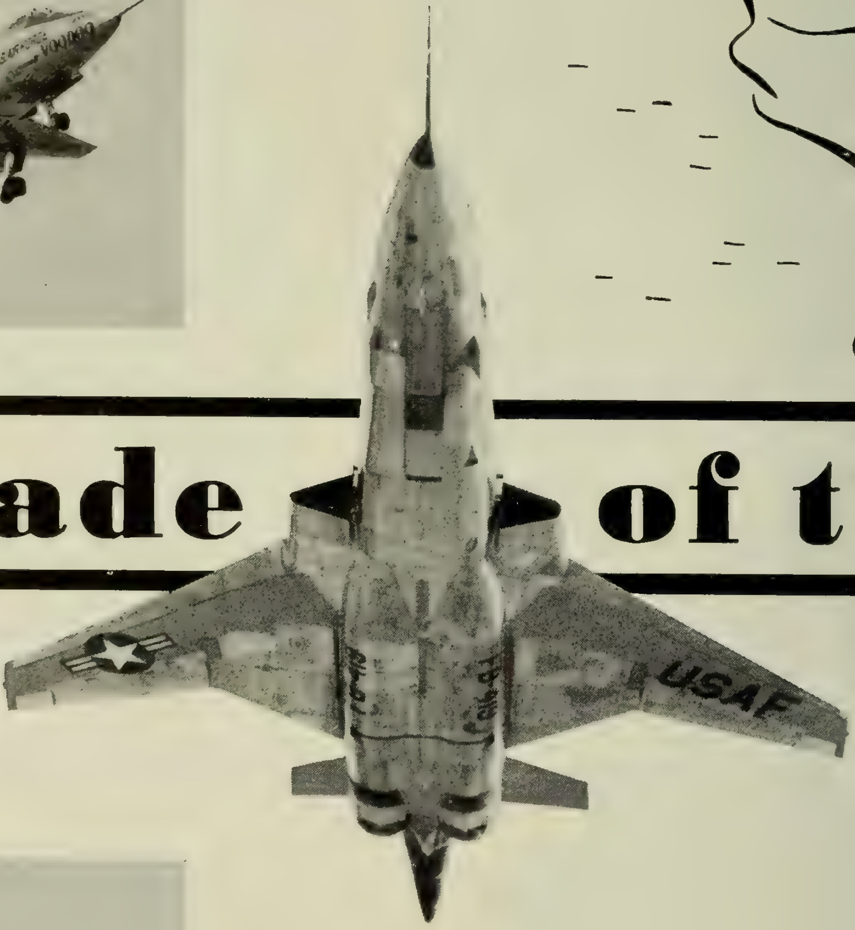
In a flight of two, the takeoff and climb were normal and the aircraft leveled off at 25,000 feet. After practicing some familiarization air work, the pilot returned to the base to shoot some touch-and-go landings with the flight leader acting as chase-instructor-pilot.

On the second touch-and-go landing, the flight was told to make a late break to allow another aircraft to clear the runway. The pilot executed the break with dive flaps, approximately one-third of the way down the runway. The gear was dropped on the downwind and the pilot started his turn to base leg at 170 knots. Flaps were lowered to the full down position on the base leg. The pilot rolled out on final approach, maintaining 165-170 knots with power.

About half way down the final, the IP advised the pilot to "set it up for 130 knots." At this time the pilot reduced power and raised the nose of his aircraft. The chase-instructor pilot started to slide by him just as Mobile Control advised him to correct his approach. The chase-IP then told the pilot to add power but the aircraft continued to sink at an excessive rate. It hit the runway on the right main gear in a stalled condition. The right pylon tank was jarred loose on impact and the left main tire blew. The pilot managed to stop the aircraft and evacuate without further incident.

According to the board, the primary cause of this accident was the instructions to the pilot on final which led to incorrect action by him. Prior to this flight he had flown one hour and 50 minutes jet time in the previous 60 days (two rides in a T-33 with IPs). He failed to qualify for checkout.

Parade of the



Robert C. Little
Chief Test Pilot
McDonnell Aircraft Corporation

Here is the latest on the "next generation" of fighters. The F-101, named the "Voodoo," is scheduled to make its debut into operational service in the near future.

IN THE PAST, I have found many of these "How to Fly" articles so full of "wild blue" that it is difficult to realize their relation to flying safety or even their usefulness in presenting basic facts to the average reader. I treat the development and test flying of a new airplane as a business, admittedly exciting at times, but nevertheless a serious business.

With this thought in mind, I would like to give you the facts, not restricted by security, on the F-101 and let you stack up the "wild blue" when you fly the airplane.

No one person or no single handbook of written instructions can automatically make you a safe and efficient pilot. You are the one who must get the feel of a new plane, exercise the right judgment and develop the correct flying techniques. Knowledge is a necessary form of safety, however, as you all well know. I suggest that you read the pilot's handbook on the F-101 and discuss the flight characteristics with other pilots who have flown the aircraft.

It is also a good idea to make use of the flight simulator. It was built for you, so use it.

I hope that this article will aid you in getting more out of your early Voodoo flying and make your transition a safe and pleasant one.

The Voodoo's flight characteristics aren't much different basically than other high performance aircraft you have been flying. It's the next generation of fighters, sure, but it flys the same. It just does everything faster. There is a lot of airplane in the F-101, both in size and mission capability. This aircraft is 67 feet long, has a

Centuries

wing span of 40 feet and is 18 feet from the ground to the top of the fin. Gross weight varies from 49,000 pounds, with two external tanks and MK 7 store, to 28,000 pounds, clean at the completion of the mission.

Twin engine reliability is available with two J-57 engines developing 15,000 pounds of thrust each with afterburner. The Voodoo has 35-degree swept wings and is capable of speeds from 160 miles per hour to over 1100 miles per hour, altitudes from sea level to over 55,000 feet, extreme rates of climb, and maneuvering capabilities throughout. Inflight refueling may be accomplished easily with either the flying boom or the probe and drogue type tankers.

Over the past two years of development, many improvements have been incorporated into the aircraft, making it a safer and easier one for you to fly. It is not a T-33 however, so I believe that the Voodoo driver needs to be both a good fighter pilot as well as a good bomber pilot for the following reasons:

- You are handling more thrust per pound of airplane than you have ever felt before, so it is especially important that you stay ahead of the aircraft and be prepared for the very rapid acceleration and high rates of climb possible.
- This fighter has a very high wing loading (110 pounds per square foot at normal takeoff gross weight) which means that for certain conditions, particularly high gross weight takeoffs and landings, you must handle this airplane like a highly wing loaded bomber aircraft.

In other words, you have a tremendous amount of thrust available and plenty of control but you can't expect to horse this airplane around with wild abandon at low airspeeds.

Let me point out briefly some of the things to expect and some of the techniques you should use on an average flight with the '101. I'll start with ground handling.

Ground Handling

Once you have the engines running and have completed your pre-taxi checklist, you are ready to go. It takes a little power to start rolling, however, the thrust in idle is enough to keep you going. Use the nosewheel steering for taxiing rather than differential braking. You can double the tire life with care in taxiing by using slow speeds especially when making sharp turns. The '101's power brakes have excellent feel, but when coming to a full stop during taxi, some brake-strut chatter may be encountered. Anticipate turns and full stops and it won't bother you.

Takeoff

Once you are lined up on the runway for takeoff, check each engine separately—leaving the other in idle. The brakes will hold with both engines in military, however you will probably rotate the tires on the wheels

With stores or external tanks installed, there is no change in Voodoo flying characteristics.

You will like maximum level flight speeds attainable. Zoom climb supersonic holds promise.

which isn't conducive to safety. After you have checked your engine and are ready to go, advance both throttles to approximately 85 per cent rpm, depress the nosewheel steering button, release the brakes and continue the throttles to military as you start to roll. Because of the ram air-bellows type artificial feel system, you will find very light stick forces on the ground. As you pick up airspeed on takeoff, these forces increase; however, during takeoff and landing they are lighter than other types of feel systems to which you might be accustomed. Therefore, during takeoff and landing, don't rely on stick forces, but use airspeed as a basis for proper aircraft control.

On your initial checkout a military power takeoff is advisable since the acceleration with afterburners is terrific and may take you by surprise. Even with military power, you will have better takeoff performance than most other fighters using maximum power. Use the nosewheel steering for directional control until the rudder becomes effective at approximately 70 knots IAS. Use the brakes only if the steering malfunctions. The same old fundamentals you've been using still apply. If you ease the nose gear off at 150 knots and relax stick back pressure, to hold your attitude, the aircraft will fly itself off as speed increases to approximately 165 knots IAS. The gear must be retracted immediately in order to prevent exceeding the gear placard of 250 knots IAS. With some airplanes you know that a steep attitude will get you on the back side of the power curve and you'll never get off the runway. In this airplane, rapidly rotating into a steep attitude can get you into just as much trouble. Sure, you can horse this airplane off the ground at airspeeds lower than recommended but even with all that power you can get in a bind. Why not play it cool and stay out of any difficulty?

Climb

You will find the acceleration of the F-101 after takeoff, very rapid. When maximum power is used, you will reach best climb speed in a minute or less (depending on temperature) after brake release. In order to maintain this climb speed the nose must be rotated steeply unless a supersonic climb is desired. You'll find it easier to maintain climb speed at maximum power with the machmeter and attitude with the artificial horizon. Using military power, the rate of climb is naturally lower, and the attitude is not as steep, presenting improved visibility over the nose.

Altitudes well above the combat ceiling may be attained by employing what is known as the zoom climb. This capability holds real promise as a new tactical intercept technique for use in attacks at extremely high altitudes. It makes use of the high kinetic energy that can be developed by the Voodoo in supersonic level flight.

Level Flight

The level flight acceleration of this big bird is impressive at all altitudes and you will like the maximum level flight speeds attainable by the aircraft. (These speeds have exceeded the original contractor estimate.) Flying qualities are stable and control characteristics are positive throughout the placard speed envelope of the F-101. No wing drops or transonic speed effects are encountered. You will notice a faint airframe buffet around 0.90 Mach number, however, supersonic flight is completely smooth.

The F-101 carries 13,000 pounds of internal fuel and you will like the amount of burner flying available without having to stay in the vicinity of the base. Nevertheless, you should follow the fuel gaging procedures set forth in the Dash One to assure that the proper sequencing is obtained, and that the master fuel tank does not get too low. Extensive use of the afterburner will run you just as short as in any other airplane.

Maneuvering

The Voodoo, being a true supersonic airplane, is not designed to have high maneuvering capabilities at subsonic speeds. You will find, however, that the maneuvering capabilities at supersonic speeds are excellent and that you will be able to maintain both Mach number and altitude during supersonic maneuvers in a far better fashion than in any other airplane you have ever flown.

The maneuverability of all fighters you've been flying was restricted by structural strength and the F-101 is no different. Again, follow your handbook placards.

In some of the airplanes you've been flying, you have experienced a characteristic commonly known as pitch-up. While pulling G in a turn, you reached a point where there was a sudden strong tendency of the airplane to nose up without the addition of stick force on your part.

The F-101A displays this undesirable characteristic, but all airplanes will be delivered with an adequate pitch-up warning device. This device incorporates a horn which sounds in your headset when you approach the pitch-up boundary, and a stick pusher which actually pushes the stick forward for you in case you should reach the pitch-up boundary. The horn and pusher signals are actuated by angle of attack and/or aft stick rate, and are scheduled with Mach number. If you hear the horn, relax your aft stick pressure or ease the stick forward slightly.

If, for certain flight conditions, you have pulled through the horn warning and have engaged the pusher, you will find that the stick will be moved forward at a rate of 1½-degree/second stabilator motion. This pusher actuation provides a final positive warning to the pilot to take corrective recovery action. Also, it will disengage after two degrees of stabilator nose-down motion. Pilot overpower force for the pusher is 25 pounds.

In case of malfunction of the pusher, a disengage button is provided on the stick; also, on-off master switches for the horn and pusher, a test button and a malfunction warning light are prominently located in the cockpit. With either gear or flaps down, the pusher becomes inoperative for safety reasons since an unexpected stick push might be dangerous during critical portions of a takeoff or landing. The horn warning stays operative on angle-of-attack as an additional safety feature for landing and takeoff.

The horn and pusher are for your safety. Take warning from them and stay out of trouble!

Spins

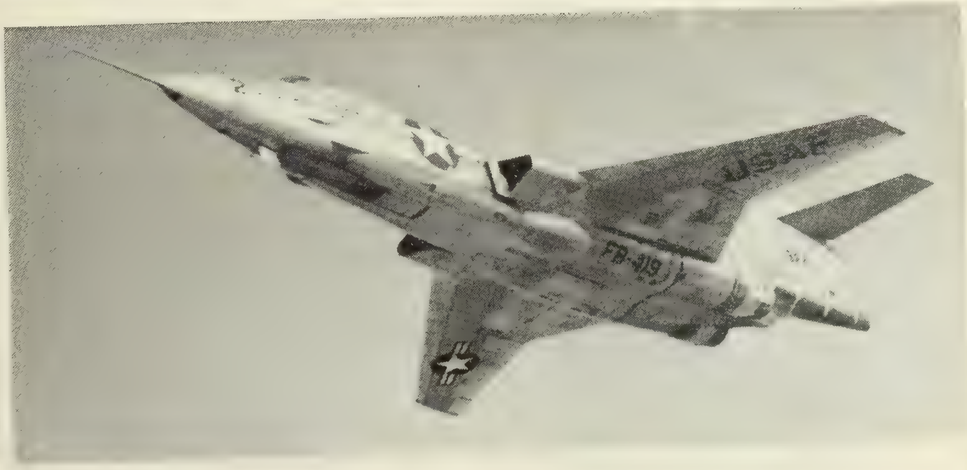
Although we have performed more than 65 spins in the F-101, the demonstration is not complete and recommended recovery procedures in the Dash One are subject to change. If you don't ignore the pitch-up warning horn and don't overpower the pusher, you will never have a spin. However, should you somehow manage to spin the F-101, follow the latest handbook instructions. The spin itself is not a violent one but you should expect to lose from 10,000 to 15,000 feet with currently recommended recovery techniques.

Engine Operation

The design of the F-101 is such that normal operation of all systems is available with either engine shut down. The J-57 has proven to be a good, rugged engine, and with two of them you can't miss unless you run out of gas. (Deadstick landings, by the way, are not on the approved list of maneuvers for the F-101!) Engine airstarts are excellent and you will be impressed with the single engine performance of the bird. We have never encountered an engine flameout. You will find it comforting to be able to shut down an engine with no sweat if a malfunction is suspected.

Compressor stalls won't bother you in your normal flying but they may be encountered at very high Mach numbers in combination with high load factors. They can vary in intensity from mild pops to heavy bangs. Stalls may cause a burner to blow out but a relight usually can be obtained immediately. A compressor

Twin J-57 engine installation allows you to shut one down, no sweat, if malfunction occurs.



To maintain best climb speed, nose must be rotated steeply unless supersonic climb is desired.

stall also may occur during some gunfiring conditions. Concentrated efforts presently are being made to correct this undesirable situation.

Landing

Since the easiest time to have an accident is during landing, we should all pay particular attention to this phase of the flight. As I said before, the F-101 has a very high wing loading which means you can't get gay with the airplane on the final approach. I drop my gear at about 230 knots on the downwind leg and then close the speed brakes and extend the flaps at about 200 knots.

For an average landing with 3000 pounds of fuel remaining, you should set up a smooth pattern from the base leg to flare out at 170 knots. I maintain a rate of descent of about 1000 feet per minute using 82 per cent rpm on both engines.

You should fly the airplane onto the runway and never try to float in that last quarter of a mile with the throttles at idle. The deceleration of the Voodoo—once you chop power and begin to flare out—will surprise you. It is on the order of five knots per second. Don't get caught in this position 50 feet in the air and a quarter of a mile short of the runway or you just won't make it.

Fly the '101 onto the runway and make a normal touchdown at about 150 knots. Parabrake deployment presents no problem for any normal crosswind condition and there is no pitch transient. Consult your Dash One for the proper landing pattern speeds versus fuel remaining.

For single engine landings, you should fly the same basic pattern as you do for normal landing, but use 15 knots higher speed. This gives you a margin to play with.

Except on hot days or high field elevations, you will have enough thrust from one engine to fly the pattern with both gear and flaps extended, however, in general you should leave the flaps retracted until you have the runway made and then dump flaps and make a normal landing. Remember that once you allow the airplane to begin to decelerate on final approach, it will be very difficult to catch it with only one engine, so set up a good stabilized approach with no steep turns.

In the event a go-around is required, use of the afterburner is recommended as an insurance factor, although military power would be adequate for most conditions.

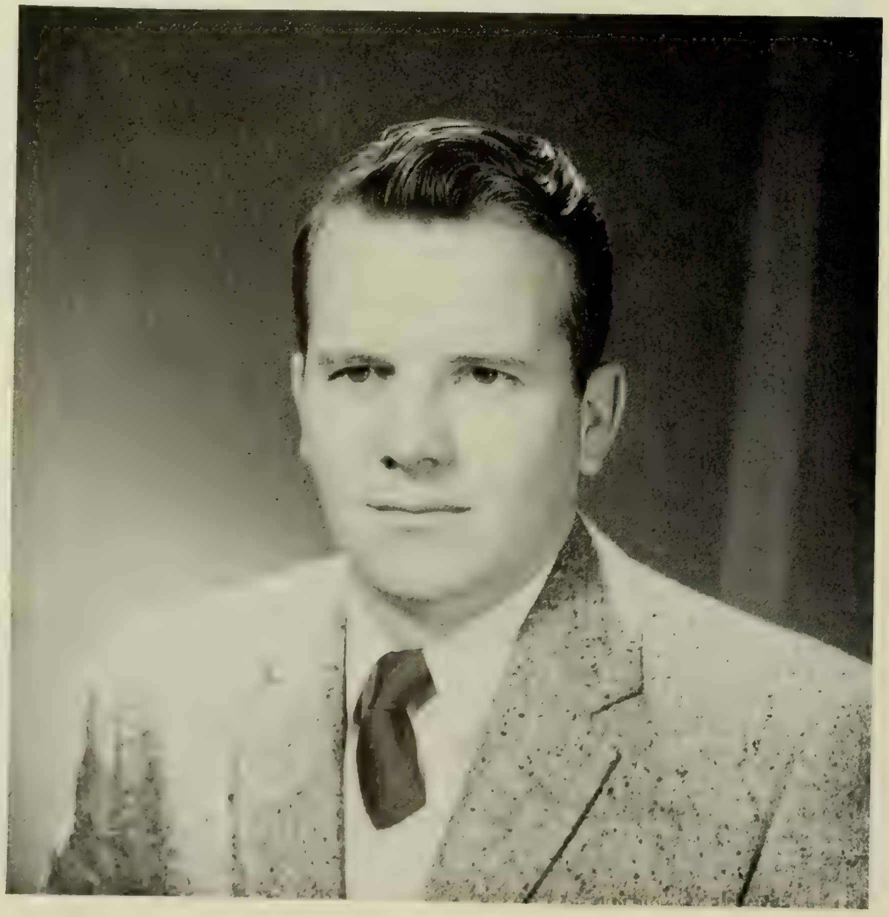
Mission Accomplishment

You will find the F-101 to be a superior weapons system equipped with the MB-1 cruise relief autopilot, ASN-6 (GPI) dead-reckoning navigation system, ARN-14 navigation radio, MA-7 fire control system with the all-weather radar and optical gunsighting, the APS-54 radar warning system, and the MA-2 low altitude bombing system. Space and security does not permit me to delve into details of operation, but highly successful special weapon strikes have been flown under simulated and actual instrument conditions using radar and ASN-6 (GPI) as the only navigational aid for the entire flight right up to the target in question which was of the order, in size, of an airfield.

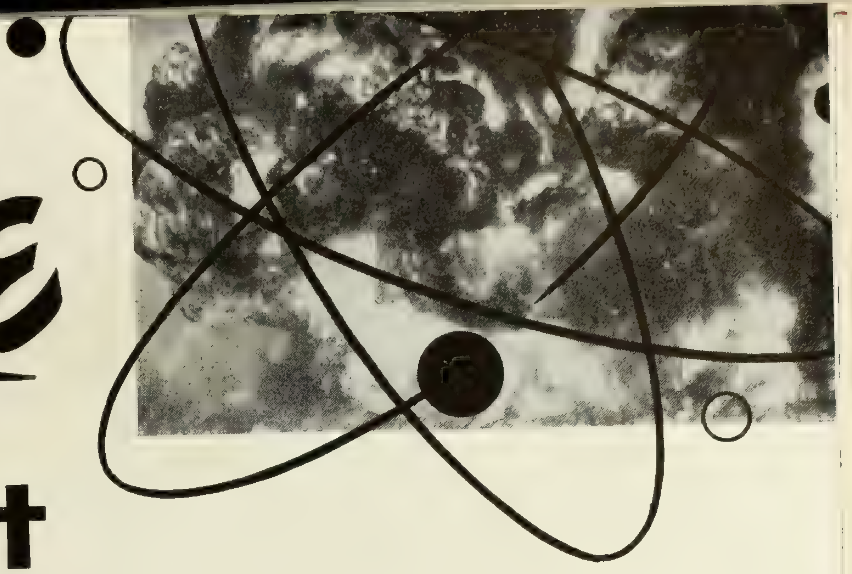
Special stores have been carried and released throughout most of the F-101 flight envelope. The F-101 is capable of level supersonic flight with stores or external tanks installed and without any change in flying characteristics. With these all-weather, long range capabilities, you will be able to deliver attacks on extremely distant targets with ease.

Well, I hope this article will be of some help in getting to know your F-101 better. The finer points are sometimes the most important. ▲

During WW II, Bob Little flew F-51s in the European Theater. He completed 68 combat missions and was awarded the Distinguished Flying Cross. Following the war he graduated from Texas A&M, with a degree in Mechanical Engineering, and became a flight test engineer for McDonnell Aircraft Corporation in 1948. He performed the first flights in the F-3H Demon and the F-101 Voodoo.



Force of habit



The development of a "habit" can save you a lot of mental gymnastics. The trick is learning when to rely upon it.

IT IS NOT CLEAR just what learning is, but an important psychological factor associated with it is habit interference. Once you've learned some sequence of acts after a great many repetitions, it becomes a relatively permanent part of your response system.

As you acquire skill in any activity, parts of this activity become more and more stereotyped and require less and less attention. In other words they become habits. Even a complex activity, if repeated often enough, will become so habitual that it is almost completely automatic. This situation produces some problems but the advantages far outweigh the disadvantages. We could not function if more than a limited number of our activities required voluntary control. While doing some things habitually, we are able to attend to other, unpracticed activities.

However, there are occasions where the movement which has become habitual is not the appropriate one; then, an "error" results. We respond habitually to aspects of our environment with which the movements have been associated. This does not mean that the stimuli are always identical, but that they are perceived in terms of their common aspects. For a simple example, you can walk down a street in conversation with a friend and step up and down curbs without being aware of it, even though the curbs differ in material, color and height. On the other hand, when a given pattern of stimuli call for a response differing from the habit that has been learned, the tendency to move in accordance with the habit is very powerful and very likely to occur. The tendency is more powerful in an emergency or under the stress of strong emotion.

The application of this human characteristic as an explanation of accidents is obvious, particularly in transition from one aircraft to another, since—normally—aircraft have different locations of controls and require different types of movements.

The following is a case in point: A pilot was performing an initial checkout ride in an F-89D. Upon completion of the air phase, he entered the traffic pattern for landing but overshot the final approach and made a go-around. His second entry was normal—all airspeeds were within limits and touchdown was about 1000 feet from the end of the runway slightly to the left of center.

As the airspeed decreased to 100 knots, the pilot applied brakes, skidding the left tire. Moments later, he locked both brakes, blowing out the right tire and then finally the left one. The aircraft swerved off the runway and hit a ditch 3½ feet deep and 5 feet wide. This sheared the right main gear. The aircraft then hit a mound of dirt 10 feet high. Here the flight ended.

Cause factors? Multiple.

The pilot's previous jet experience was in F-86Ds. In that type of aircraft it is standard procedure to begin braking action as soon as the speed goes below 100 knots. Probably as a result of stress and channelized attention, he reverted to this well-established habit pattern and began braking action at slightly under 100 knots, causing tire failure and loss of control. (Granted, the ditch and the mound of earth just shouldn't have been there. But they were.)

The comment by the Aero-Medical Safety Division, regarding this accident, is interesting:

"Concur with the flight surgeon in his evaluation of the pilot's action. With only one hour in this type aircraft, the pilot reverted to the procedures with which he was more familiar. The result was premature braking action which precipitated an accident. The problem of transitioning in a tactical unit remains a critical one. With rare exceptions, either the transition training mission or the operational mission must be neglected. Often both are compromised. Seldom are both adequately fulfilled."

This involves a plain and simple case of having to face the facts. You must keep in mind that this new airplane is different. Sometimes major differences even exist in airplanes of the same type.

When a technique becomes embedded through hundreds of hours of experience, the response is almost automatic. In order to change, it is necessary for the old response to be superseded by the new. This only can be done by extended practice in the new activity.

This habit interference cannot be considered forgetting. It is a built-in limitation which can be demonstrated in the laboratory as well as in operational situations. (Do you still reach for the clutch sometimes on your new automobile?) In conjunction with this, the use of simulators, cockpit trainers and other training aids can greatly minimize the effects of this limitation. It's simply a human characteristic. Learn to recognize it. Expect it. And live with it. ▲

IN

THE ONLY reason that thing can fly is because it just doesn't know any better."

Ever hear that? Or—"Just like a bumblebee: Aerodynamically impossible!" I've been inclined to think this about several contraptions that parade themselves as airplanes. The more I look at them, the more I'm inclined to marvel.

How does an Air Force aircraft come into being? The answer to that is a story which might be called the "Life and Hard Times of a Dream."

A dream? Sure. Somebody had to have one before he started doodling on the drawing board. Or, if you don't like the expression, then call it an idea. An idea of something that was better than anything that had ever preceded it. A dream of an airplane that would far surpass the performance of those in existence.

By and large, the days of the one-man design have gone by the boards. It was fine for a time. But that was at the start, the threshold of the aircraft development era. A number of men had the courage and daring to risk their lives on a dream — the Wrights, de Seversky, Sikorsky, Martin to name a few.

But it's rare that you hear the name of an individual associated with the overall design of a plane anymore. You hear of the "Fowler Flap," the "Davis Wing," but even these are old.

How about the "slab tails," the "flying tails" and all the other design features that you more or less take for granted? No proper name associated with them? No, because names tend to get lost in the maze of design, development and production.

For many of the improvements that have been made on your machine, nobody really knows just who had the original idea. But if you want a review of people who have contributed more than the common man, drive slowly through the Edwards Air Force Base, and look at the street signs.

But let's run through the birth and childhood of a new bird. Far over-simplified, conception starts this way. Air Force planners see the need for an airplane that will meet specific, strategic and tactical requirements, and bids go out for design. Of those submitted, several are selected for study. As much as possible must be known about the proposed aircraft and its potential before ever starting actual construction.

Will it meet the requirements laid down for it? Can it be built in the time allotted? Does it provide a maximum of safety, both on the ground and in the air? Can we maintain it? How long can we expect to operate it? Or, all summed up, is it a worthwhile investment for the Air Force?

All of this doesn't happen over one cup of coffee. Nor do just two or three people get in on the act. Before the first jig has been built, hundreds of people have studied the various aspects of the bird. Before the first plane has flown, thousands of people, both Air Force and hired contractors, have combed through details of design and potential.

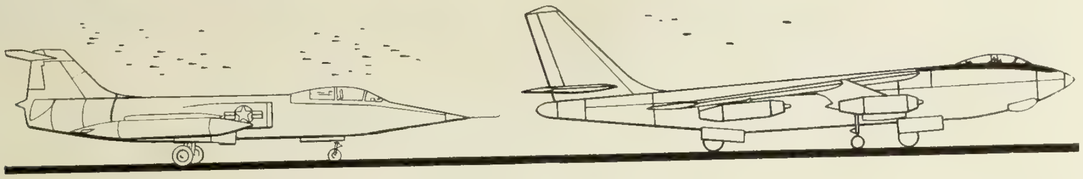
A Mock-up Board studies a full scale model of the proposed item for workability, suitability, safety and improvement. This board alone, involves dozens of people. Not only do the engineers look at the bird, there are represenatives from the Air Force Major Command which is expected to use it. It could happen that these would be chosen from the unit to which the first operational plane will be delivered.

Project officers are assigned to monitor the development of the fledgling, to study its potential and to plan its use. There are project officers in the Air Research Development Command, in Air Materiel Command, in Air Proving Ground Command, in the using command and in the Directorate of Flight Safety Research. Each officer studies his own area of interest. Finally, there is the Senior Officers Board representing Headquarters USAF to study the entire problem and to make final decisions on matters brought out by all interested agencies.

When the final nod is given, it reflects the considered opinion that, "This is the best we can do—based on what we now know." Only then does the building begin.

The key phrase here is "what we now know." We are going places where we've never been. On your first trip to the moon, you won't have a road map. And there is none here. During the actual construction of the

HE BEGINNING - - -



No airplane "just happens." Nor does any set of instructions pertaining to the operation and maintenance of that airplane. The detail and planning that actually goes into the development of an aircraft may surprise you. This story will give you an idea of how the program is set up and what happens to the bird before you get it in an operational unit.

first model, the builder will discover things that hardly anyone could have predicted concerning the actual finished product. Decisions must be made as to what to do. These are considered by members of the development board — again representing all interested agencies. At every step, tests must be made to determine if the slide rule was correct. The Constitution does not apply to a new airplane: It is guilty until proved innocent—on every count.

At every step, something new comes to light. As corrections, modifications, adjustments, substitutions and re-arrangements are made, the bird comes nearer and nearer to the big day—to that moment of truth wherein it will face the ultimate test.

Will it fly? By now there is little real doubt. It has undergone too many tests: Wind tunnel tests of components to be exposed to the blast; vibration and endurance tests; strength, shock, skid, temperature reaction tests and others ad finitum.

Despite all the plans and all the studies and all the tests, we must know what it really will do in the air, and to do this we use the so-called Phase Testing System. Flight testing of the aircraft is divided into eight separate parts. Each segment is a part of the overall test program and each has a specific objective.

Phase I

The designer said that it would fly and the contractor must have believed him. But before the first one can be "sold" to the Air Force, this has to be proved beyond doubt.

Phase I of the testing program is calculated to do just that. Called the "Air Worthiness and Equipment Functioning Phase," it is designed to show that the bird will fly and that all of its basic equipment will operate as per design. This is a responsibility of the contractor.

If you have ever wondered why a civilian test pilot always flies the first model, here's the reason. It is his job to determine air worthiness and to insure that the aircraft and equipment function and properly meet engineering specifications.

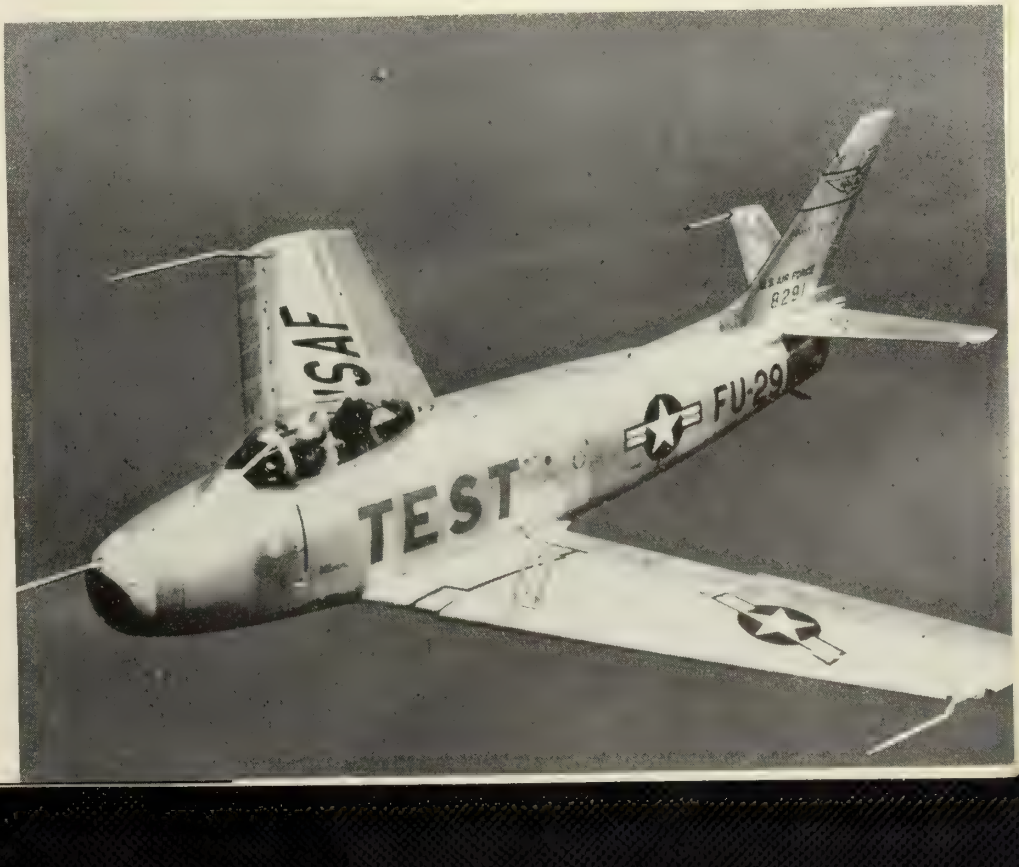
The initial flights having been made, the contractor turns the new bird over to the Air Force to meet its critical gaze.

Phase II

This gaze is not always easy to meet because the basic purpose of Phase II is just what its title implies: To check "Contractor Compliance."

This is the first Air Force flight in the new bird. It is conducted by

Specially instrumented F-86 uses booms on nose, tips and tail to find operational data for you.



test pilots of the Air Force Flight Test Center at Edwards Air Force Base. Usually, this phase is a short one. The basic requirements are to check performance guarantees and to determine the potential value of the aircraft to the Air Force. The fact that it is brief doesn't mean that little is done. It is common to expect a number of recommended changes from this phase. It is important that discrepancies be discovered now so that changes can be made before more airplanes are built. Thus, we gain time and better products.

Phase III

At this point, the testing routine is transferred back to the contractor. It is his responsibility to correct the kinks uncovered during Phase II. This, Phase III, is called simply "Design Refinement." Refinements and tests are continued until all required changes have been made.

Phase IV

Then comes one of the most important of all phases, as far as you are concerned, Phase IV. It is called the "Performance and Stability Testing Phase," and based primarily upon the results of this phase, data are furnished for the building of Dash Ones. The tests included are conducted at Edwards Air Force Base by pilots of the Flight Test Center.

This involves testing performance and stability characteristics in detail. Data are relayed to the Flight Data Branch for checking the contractor's figures. Information on control forces and deflections is passed along to aeronautical design groups. The Bible which pilots will use is on its way.

Phase V

Actually, there is a lot more to be done with this new machine. One of the big things you want to know is 'what is going to happen to the new bird and you when the weather goes lousy?' And to show you how much everybody else agrees with the necessity for your knowing, they've set up a special testing phase to obtain information and data on the flying and handling characteristics of the aircraft under adverse weather conditions. This phase is conducted by Air Force pilots at Wright Air Development Center, Dayton, Ohio.

Phase VI

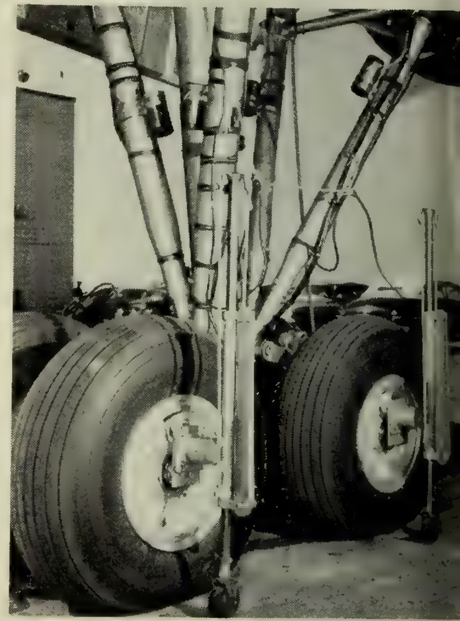
The next phase is one in which you may be requested to participate, one of these days. It is called the "Functional Development Phase."

The tests include use of three or more first production models. Commands which will use the airplane, such as the Tactical Air Command or the Strategic Air Command, as well as the Air Proving Ground Command, are invited to send pilots and maintenance personnel to take part in Phase VI tests. These tests simulate operational conditions on night, weather, maximum range, gunnery and other missions.

This phase usually requires about 150 flying hours per aircraft. The Air Force Flight Test Center project engineer prepares a report at the end of the test in which he sets up maintenance requirements, parts consumption and inspection times. This report also covers the adequacy of initial personnel skills and training requirements. Field commands use this report in drawing up their operating requirements.

At the end of Phase VI, if the Air Force Flight Test Center reports that the aircraft is a weapons system capable of doing a job, the Air Proving Ground Command determines how this weapons system can be used by a tactical unit. The AFFTC determines an aircraft's flying characteristics; the APGC determines an aircraft's combat capabilities.

A civilian test pilot flies it first.



Phase II checks and modifies faults.

Maintenance personnel participate in tests which simulate normal operational conditions.

How will it perform under combat conditions? The test of a tactically equipped airplane.

Phase VII

The tests included in this phase are conducted by the Air Proving Ground Command. The phase is known as the "Employment and Suitability Phase" —or Phase VII. This is a test of tactically equipped airplanes to determine how they will perform under combat conditions. These tests are conducted at Eglin Air Force Base.

Phase VIII

Phase VIII—"Unit Operational Employment Testing" — also is monitored, but not conducted, by the Air Proving Ground Command. Just as the phase title suggests, you are the guys who'll do the work. This phase includes testing and evaluating operationally configured equipment. This is accomplished at an operational base with personnel and equipment authorized in a squadron. This means simply that we try it out under everyday, operational conditions. The unit normally chosen to participate in these tests is the first unit to be equipped with the airplane.

Simultaneous Testing

Looking at the rundown of the various phases of the Flight Test Program, you may think that they happen in a one-two-three order, with each waiting for the preceding test to be finished. This is not necessarily true. It depends largely on the availability of airplanes.

The entire program is rigidly controlled and planned in detail to complete the tests with all possible speed, obtaining a maximum of information. Usually, the first eleven airplanes are designated as test items. While these may later go into operational use, they are scheduled initially for the flight testing program.

Obviously, Phase I should be completed prior to the beginning of Phase II. Phase III should be concluded prior to he beginning of Phase IV, but it is not absolutely mandatory under certain conditions. For example, if refinements are minor in nature, other testing can be initiated prior to completion of all the refinements being made by the contractor. By this time, the assembly line is picking up speed and new birds are coming off. As fast as they are made available, they go into the various phases of testing outlined above.

While Phase IV is in progress at Edwards Air Force Base, Phase V might also be going on at Wright-Patterson. By the same token, Phase VII might be started at Eglin and the boys at Edwards would be shaping up to run the Phase VI tests there. It is a closely knit operation with information being interchanged on what nearly amounts to a daily basis.

The experience of all the testers is furnished to the Flight Data Branch which is the agency responsible for the contents of the Pilots Operating Instructions—the Dash One. The long and short of it is just this: By the time the new bird has been in the field for a couple of months, it has been tested for about everything there is to test it for. To that extent possible, the "bugs" found by test have been ironed out, and you are given a pretty good idea what to expect in your Dash One.

For some, it may be nice to know that all of these tests are voluminously documented. If you have a need for proof, it is available.

So it really isn't "aerodynamically impossible." It's the calculated refinement of a dream. And although the lead sled you happen to be driving at the moment may not seem to fit right into that description, there was a time when we could actually say, "This is our best—based on what we now know." ▲

Many come but few are chosen. That a plane is built does not guarantee its acceptance.

LOOK

Capt. Elmer L. Barnes

38th Air Rescue Sq (MATS)

WE WERE FLYING one of those strange and peculiar beasts known as an SH-19B type helicopter. I've probably had as much experience as the average 'copter pilot, considering the number of years I've been flying these airborne windmills. I have served as an instructor pilot and test pilot at the helicopter school, and I've had many hours of operational flying, plus 135 combat missions in Korea. Needless to state, inexperience is not a factor in this particular story.

The flight started as one of those that promised to be two hours of pleasant flying, but as you will see, it didn't work out that way.

Another qualified chopper pilot and I filed a local flight plan (I was acting as IP) and after proper briefings, preflight and checks, we took off.

As our flight progressed, the pilot, who was in the right seat of this pulsating piece of mass-produced nightmare, made an approach to a landing at one of the small liaison landing strips located on this base. As we came to a hover, one of those little idiosyncrasies related only to the helicopter, made its presence known. This item is known as a one-to-one lateral beat. Layman language would describe it as being a sidewise shuffle; one shuffle per rotor revolution. It attracted my attention and I became interested in finding its cause. The other pilot—still doing the flying—made another takeoff and we proceeded to another landing strip. Again we made an approach to landing. As the approach was started, this one-to-one beat became active again. At the end of this approach, we landed.

I decided to take the controls to try to find the cause of this one-to-one beat. (One of the causes of this type of beat can be a malfunctioning blade damper on the rotor head.) A check was made and I found that one of the dampers was not in phase with the other two. This condition is not considered very serious and my chief interest was to try to isolate it.

After I had made this check I decided to try another of a different type to see if the lateral would appear in this one. This check was to be a short field takeoff. I proceeded with the takeoff and found that my pitch and throttle controls had reached their limits just as I had attained my red line power. In the SH-19B type helicopter, at least 44" Hg should be available, if needed, although the red

Valuable asset of the "Chopper" is the rescue sling/hoist assembly designed for inflight pickup.

OUT
elow!

Just how much experimenting should one do to find cause of one-to-one lateral beats in flight?

line is at 39.5″ Hg, because of structural limitations.

(One thing I wish to bring to your attention is that I now have much "hindsight" to guide me in writing this article—while the flight was being flown by "foresight.")

Finding that I had runout of control on my pitch and throttle caused me to forget all about my little one-to-one beat that I was tracking down. This new condition caught me by surprise and I changed my type of check to find the cause of my new dilemma. I immediately thought my rigging was off. One of the checks for rigging is to perform an autorotation to see if the rotor RPM in the autorotation is as it should be. In this case, it was. After this was completed, I came to a hover and made another short field takeoff. Again, I found that my control on pitch and throttle had reached their stops at red line power.

None of these conditions impressed me as being serious enough to return to base immediately and land, to find out my troubles. I had encountered the one-to-one lateral beat many times in my course of helicopter flying. The control limitations still allowed me to obtain all the power that I was permitted to use, except in *emergencies*. I decided to continue the flight as planned and at the end would write up my findings and let maintenance find my trouble.

At the end of about an hour and 15 minutes of flying we decided to return to our base. I intended to demonstrate a downwind approach to the other pilot—who was also an IP. The wind at this time was reported by the tower to be from the NNE at 10 knots. Indications on the ground were that the wind was from the SW at about the same velocity.

The approach was started on a heading of NNE and was a good one until about the 75-foot altitude was reached. The chopper started a rapid rate of descent and I noticed I was overshooting my intended landing spot. By this time I had applied all my available power and found that I could not reduce my rate of descent fast enough to stop the chopper in time to avoid striking the ground before I intended to. The terrain ahead was rough and overgrown in tall grass. I therefore started an immediate turn, hoping to get into the wind in time to stop my rapid fall and also to stay out of the rough ground ahead.

I turned to the right because in helicopters a right turn will provide a small amount of additional power, since the turn is being made with torque. Before I could stop the descent and level the chopper, it struck, causing the right main landing gear to break off.

After the accident had occurred, it was found that the carburetor air door was partially closed due to a malfunction of the linkage system which caused a restriction of the amount of air that could flow through the opening.

What was the cause of this accident? Was it caused by my putting the helicopter into a condition which I was unable to recover from? I had performed this maneuver many times before and always had recovered, with power to spare.

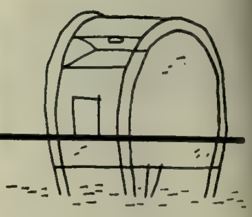
Was it caused by the fact that not enough pitch control was available when it was needed? Was it caused by a sudden shift of wind? Was it caused by the malfunctioning carburetor air door? Or, was the cause a combination of all these conditions?

No matter what caused this accident, one thing could have prevented it: A *precautionary landing* when the control trouble was first found! If I had returned to the ramp and landed, maintenance could have given this "infuriated palm tree" a good look see and probably would have found my trouble before it was brought to their attention the hard way.

I have learned that a precautionary landing has never cost the government one thin dime on aircraft repairs. Take a lesson from me when you find a doubtful condition prevalent. Land that machine you're flying before you find that you are between the well known "rock and a hard place," and wind up with a mass of twisted metal to your credit. ▲

CROSS FEED

LETTERS TO THE EDITOR



Mister Contractor

Reference is made to the article "The Braking Point" in the December issue of FLYING SAFETY.

This contractor studied the subject article with interest, since in normal business with your Command, this contractor comes in day-to-day contact with the author, Mr. Wm. M. Roberts.

This contractor is pleased to advise you of the excellence of the article and of the high regard of this contractor for the author.

The Frank G. Schenuit Rubber Co
Roy C. Neely, President

Thanks for the kind words, Mr. Contractor!

Little Red Blinker

I've read with much concern, both in your magazine and in civilian magazines, about the crowded airways which are caused by the limitation of the human eye in even the clearest visibility. Air Force and CAA Regulations will soon request pilot reporting of details on near mid-air collisions. It must be getting "hairy" and I, for one, hope that a solution to the problem will be made soon.

I am wondering, if by chance, your office and the Civil Aeronautics Administration have thought of the possibility of the old tail warning light which was installed on P-51 aircraft in the ETO during the "Brown Shoe" war. Here was a simple device whose weight was negligible on the aircraft. It consisted of a compact little radar set in the aft section of the fighter with a red blinker in the cockpit to warn the pilot that another aircraft was approaching from approximately 2000 to 3000 yards and was in the same line of flight.

A simple jink of the stick in any direction would make the warning light go out and the closing aircraft would not be in the same line of flight. It was an effective little gadget used primarily as a defensive tactic against an enemy fighter making a sneak attack from the rear. It could be used today to prevent midair collisions. At least it would get two aircraft out of the same line of flight, forward and aft, provided another compact set was installed in the forward section of the aircraft.

A red blinker, like in the old P-51, could warn of overtaking aircraft.

A green blinker in the cockpit could warn straight-ahead approaching aircraft.

It would definitely minimize the most dangerous head-on and "overtaking" hazards. Lastly, it would facilitate those near mid-air reports that you and CAA will soon be asking for.

The device is a simple electronic gadget designed for F-51s. Also I believe it parallels the same principle of the old radio compass.

In summary, the gadget is effective, is of negligible weight and will certainly augment the over-taxed eyes of pilots flying in a crowded sky.

Maj. Lucius G. LaCroix
3550th PM Sq (T-33)
Moody AFB, Ga.

I remember that gadget. We had the same thing on the P-38s. The airlines are evaluating a like principle.

Crash-Rescue Manual

This is in regard to the letter from Captain Byers in the December issue of FLYING SAFETY. We, in ARS, also are interested in a crash rescue manual, but information indicates that one is not in the "works." A training aid does exist. It is AF Visual Aid Chart AFVA 50-8, "Emergency Rescue Information for Aircraft." This set of charts consists of 77 sheets, 33 x 40 inches in size. This is fine, but rescue personnel (including ARS, base crash-rescue and firefighters) need a *reference* manual.

It is hardly conceivable that anyone could memorize all the crash-rescue information for each type of aircraft. I believe that all organizations that have a requirement for a crash manual should make their needs known to the Air Force through URs or letters. I know that ARS has, but it is only one organization.

Capt. Donald G. Jones
Hq ARS, Orlando AFB, Fla.

Several have written, in reply to Captain Byers' inquiry by referring to the set of charts designated as AFVA 50-8, "Emergency Rescue Information for Aircraft." In fact, a set has been presented to this office.

As to your suggestion for a crash manual for each organization, it's a good one, Captain!

From the Navy

We read with a certain emotional 'pang' the article in the September issue of FLYING SAFETY by Lt. Col. Mitchell J. Mulholland, entitled 'Oops—Wrong Switch.' It presents vividly the problems we are faced with solving here at the Navy Electronics Laboratory. I am sorry that the Colonel did not mention that much intensive work is in progress, which aims at eliminating the problems confronting the human operator in the performance of his flying duties. The troops, especially the younger 'Tigers,' should be acquainted with this fact.

Once more, our many thanks and best wishes for a continuing 'quality' publication.

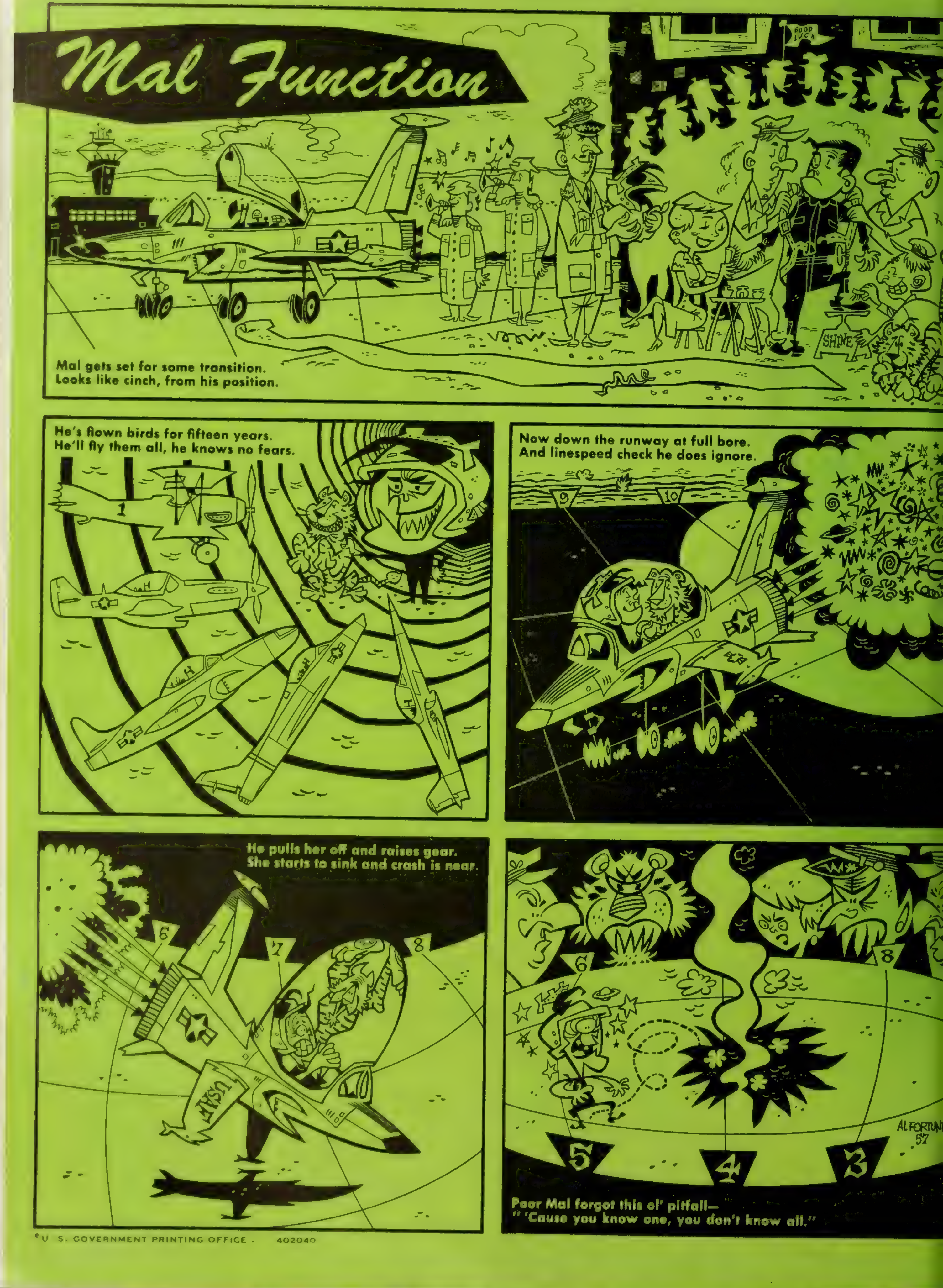
Lyle E. Hufford (1/Lt USAF, Ret.)
U.S. Navy Elec. Lab
San Diego, Calif.

Good to know that things are being done to cut down on some of the problems. And, thanks for the pat on the back regarding FLYING SAFETY.

s *all down in*

BLACK and WHITE

Yes, it's all in black and white. The figures show that transitioning to a different aircraft is the time when you're a patsy for an accident. You may be a high-time type with years of experience but when you check out in that new bird . . . you're a student. Learn your task well and prove that the transition from one aircraft to another need not contribute to the aircraft accident toll.


Mal Function
GOOD LUCK
SHINE
Mal gets set for some transition.
Looks like cinch, from his position.
He's flown birds for fifteen years.
He'll fly them all, he knows no fears.
1
Now down the runway at full bore.
And linespeed check he does ignore.
9
10
He pulls her off and raises gear.
She starts to sink and crash is near.
6
7
8
USAF
6
8
5
4
3
AL FORTUNE 57
Poor Mal forgot this ol' pitfall—
"'Cause you know one, you don't know all."

U. S. GOVERNMENT PRINTING OFFICE . 402040

.1305
Y5

RIL · 1957

FLYING SAFETY

UNITED STATES AIR FORCE

Flight Planning Today

File Thirteen

The subject for April, as depicted by our cover, is *Flight Planning.* Faulty flight planning is often the mistake that starts the chain reaction ending up with a smashed aircraft. . . . The T. O. on how to pack chaff in parachutes has been published and disseminated. (T. O. 14D1-2-81, dated 1 Nov. 56.) Packing the chaff in the chute rather than in the seat has its advantages. One is that chaff in the chute more accurately marks the location of the pilot. Another is in case you go over the side, sans seat, you still have the chaff going for you. . . . There have been a few incidents lately of the plexiglas in canopies blowing out. During the walk-around, it's a good idea to check the canopy carefully for cracks and nicks. They tend to weaken the plexiglass to the blowing point. . . . It appears that the B-25, reluctant to bow out of this modern Air Force, is trying to prove that it can do anything a jet can. At Andrews recently, one made a successful landing barrier engagement after the pilot landed long and was unable to stop via the normal method. The barrier cable actually engaged the undercarriage and the aircraft was stopped at 273 feet. Chalk up another save for landing barriers. . . .

A note from Kirtland AFB informs us that they do not have PFSV on UHF as stated in our Feb. issue. They have it on VHF only.

Recently two pilots requested *practice* D/F fixes when they were actually lost. In one case the pilot carried his practice so far that he had to bail.

Perry J. Dahl

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Please send Flying Safety Magazine for one year to the following address. Enclosed is a check or Money Order for $2.50. ($3.50 for foreign mailing.)
Catalog No. D-301.44.

Name______________________________

Address____________________________

City________________State__________

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major Vernon R. Stutts

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby

Editorial Asst.
Amelia Askew

Distribution
T/Sgt. William H. Johnson

CONTENTS

Flight Safety Awards 1
Flying Safety on the Airways 4
Splash Department 14
Flash Advisory 16
No Short Cuts 19
Speed Signs 20
Rex Says 23
TACAN Is Here 24
Crossfeed 28

VOLUME THIRTEEN NUMBER FOUR

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accidental stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine.* Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine,* Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

FLIGHT SAFETY AWARDS

★

★

Coveted FLYING SAFETY PLAQUES have been awarded the units listed on this and the following two pages. The awards were presented for the period 1 July through 30 December, 1956.

FLYING SAFETY salutes the officers and men of the receiving organizations for their outstanding effectiveness in preserving the Air Power of the Nation through Safety of Flight—Guardian of Air Power.

11th Air Division (Def.)
Ladd AFB, Alaska
Alaskan Air Command

Operating in Alaska, under the worst possible conditions, this unit performed defense duties flying F-89s. Below-freezing temperatures prevailed from October through April, accompanied by fog and long hours of darkness. The mission of the 11th is to provide active air defense.

•

460th Ftr-Intr Sq
Portland, Ore. International Arpt
Air Defense Command

This squadron flew 14,403 hours during the reporting period, with only one minor accident. Missions were performed in both the F-89 and F-86D aircraft. Additional operational handicaps resulted from having to operate out of a busy international airport. Air defense scrambles were performed around-the-clock regardless of weather conditions.

•

355th Ftr Group (Def.)
McGee-Tyson Arpt, Tenn.
Air Defense Command

Flying F-86Ds, this unit flew 10,645 accident-free hours. As an active Air Defense Group, operations were conducted around-the-clock. The aircraft operated from alert hangars situated at the end of the runways and, in the event of an alert, were required to be airborne in five minutes—or less.

•

Hill AFB
Ogden, Utah
Air Materiel Command

Over 14,000 hours were flown in a variety of aircraft, which included F-89s, F-84s, F-101s and C-124s. Most of the flying was in executing test flights. Despite the high accident potential involved with test flying, the only accident marring a perfect record involved an F-101 performing spin tests.

•

3575th Pilot Trng Wg
Vance AFB, Oklahoma
Air Training Command

This wing flew 63,243 hours without an aircraft accident or incident. Sixty per cent of the operation involved maximum performance maneuvers such as simulated forced landing, no-flap landings and such. A large part of the flying was performed by students with less than 150 hours total time.

3603rd CCT Sq

Luke AFB, Ariz.

Air Training Command

The mission of this organization is to train pilots in all phases of fighter-bomber operations. During this period the pilots, including instructors, transitioned to a new aircraft, the F-84F. This transition was completed without a single mishap. The student pilots were basic school graduates.

•

35th Ftr-Intr Wg

Yokota AB, Japan

Far East Air Forces

This fighter-interceptor wing has the responsibility of defending Central Japan and maintaining an alert status. Maintaining an operational readiness requires operation in all types of weather. The unusual conditions prevalent in this area such as mountainous terrain are hazardous.

•

51st Ftr-Intr Wg

Naha AB, Okinawa

Far East Air Forces

This unit is stationed in a typhoon area that has rapidly-changing and often severe weather conditions during most of the year. Limited communications and navigation facilities add to the risk of operation from the island. The wing made 10,800 landings, and flew 791 hours of weather.

•

1254th Air Trans. Gp (Med.)

Wash. Nat'l Arpt, Wash. D.C.

Military Air Transport Service

This organization, since its inception, has flown 83,632 accident-free hours. Types of missions ranged from world-wide air transportation for the President of the United States, Cabinet Members and Members of Congress, to light aircraft operation for shorter hauls. Much of the flying involved uncharted areas.

4060th Air Refuel. Wg

Dow AFB, Maine

Strategic Air Command

During the award period, tankers of the 4060th transferred 2854 gallons of fuel to jet receivers. This unit has been accident-free for a period of over four years. Regardless of conditions, the tankers must be airborne to fulfill the requirements of tactical fighter and bomber missions.

•

825th Air Division

Little Rock AFB, Ark.

Strategic Air Command

This Division flies B-47s and KC-97s. They operated without an accident for this reporting period. One wing participated in a North African deployment exercise without even an incident. All types of tactical operations were employed in maintaining the striking power of the USAF.

•

341st Bombardment Wg

Dyess AFB, Tex.

Strategic Air Command

In maintaining the capability to execute assigned emergency war plans, this unit did not experience accidents in either B-47s or KC-97s. Inexperienced crews, poor instrument landing aids and runway construction during periods of severe weather, greatly increased the accident potential.

•

312th Ftr-Bomb. Gp

Clovis AFB, New Mex.

Tactical Air Command

The mission of this organization is to attain and maintain the capability to deliver atomic weapons on designated targets. Practice delivery missions included flights at low altitudes in supersonic fighter aircraft. The unit transitioned from the F-86H to the new, supersonic F-100D aircraft.

•

464th Troop Carrier Wg

Pope AFB, No. Carolina

Tactical Air Command

The wing airlifted 5,552,000 pounds of cargo, 52,190 passengers. 3,526,000 pounds of cargo, and 43,669 paratroopers were dropped by parachute. Operations included Alaska and Panama in support of Army airborne troops. Cold weather operational tests were performed in minus 53-degree Alaska weather.

48th Ftr-Bomb Wg
Chaumont, France
U. S. Air Forces in Europe

This wing operated F-86s and later in the period transitioned to F-100s. One of the training missions is prolonged, low-level, simulated strikes over unidentified towns and terrain often omitted from available charts. There is no GCI coverage at home plate and the weather is often severe.

•

562nd Ftr-Bomb Sq
Etain AB, France
U. S. Air Forces in Europe

This unit operates F-86F aircraft and did so without an accident during this period. The primary mission is to deliver special weapons. The unit accomplished a flight across the North Atlantic. Deployments to fields having little or no facilities were accomplished in readiness drills.

•

91st Ftr-Bomb Sq
Bentwaters, England
U. S. Air Forces in Europe

During this period, the 91st Squadron flew 480 navigational sorties, logged 6194 instrument approaches, 746 hours of actual weather and 542 hours of night flying in F-84F aircraft. There were no major or minor accidents. The home station was IFR over 37 per cent of the time, necessitating instrument approaches during these periods.

•

124th Ftr-Intr Sq
Des Moines, Iowa, Mun. Arpt
Air National Guard

This squadron operated during this period without an accident or incident. It is located at a civilian airfield with only one operational runway that has heavy civilian air traffic. The unit participated in the USAF World-Wide Gunnery Meet, placing second in air-to-ground and fourth over-all.

•

127th Ftr-Intr Sq
McConnell AFB, Kansas
Air National Guard

In the execution of fighter missions and actual scrambles, this unit has not had a major accident in over 18 months. The high density traffic is a constant threat to this accident-prevention accomplishment. During alert commitments, the aircraft have never failed to be airborne in less than five minutes.

319th Ftr-Bomb Wg
Memphis, Tenn. Mun. Arpt
Air Force Reserve

This unit, composed of week-end warriors, has operated accident-free for the award period. They participated in one two-weeks active duty tour and one encampment at Eglin Air Force Base. The majority of the pilots were multi-engine qualified but transitioned to fighters without a mishap.

•

433rd Troop Carrier Wg
Brooks AFB, Texas
Air Force Reserve

This wing trains to effectively airlift personnel and equipment, using air landing and parachute techniques during simulated combat operations. Seventy-five per cent of its sorties on a tour to the Caribbean area were under IFR conditions. This unit has operated without an accident since May, 1955.

★ ★ ★ ★

Medallion Winners

These organizations are repeat winners of the Flying Safety Plaque and are awarded bronze medallions.

Pacific Division—MATS
July-December 1952

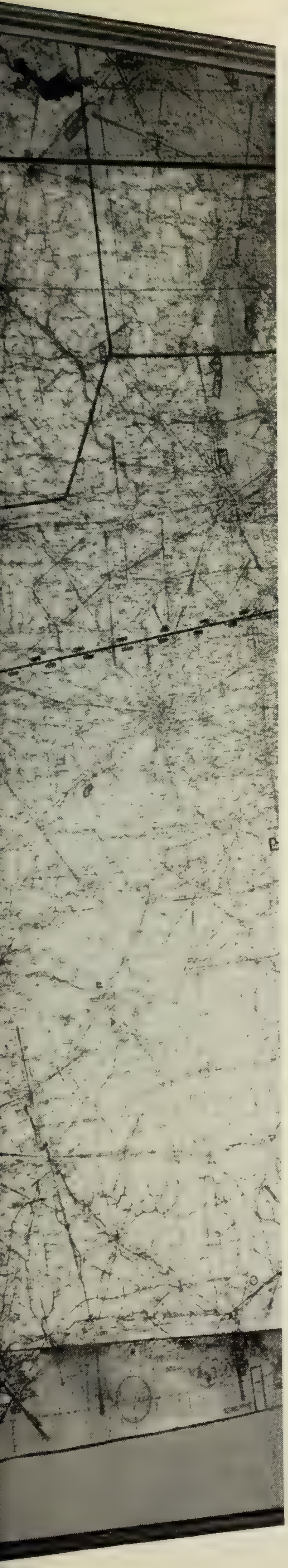
67th Tactical Reconnaissance Wg
July-December 1954

AF Cambridge Research Center
Jan-June 1955

Safety is not an inherent quality in any profession. It is one that you build in as you go and is based largely on accumulated knowledge and experience. Without adequate knowledge the experiences can get a little hairy, and safety can become a nebulous bit of fiction. To a greater extent than is generally realized, unhappy experiences can be avoided by increasing knowledge and familiarity. In short, know what you have to work with.

With this thought in mind, FLYING SAFETY Magazine presents in this issue, an up-to-date revision of a feature article which appeared several years ago (May, 1950): "Flying Safety on the Airways." The revision of this feature not only answers the numerous requests from pilots in the field, but rounds out the discussion of "Planning Your Flight"—this month's contribution to the 1957 Program.

Flight planning—or the lack thereof—has been responsible for a large share of USAF aircraft accidents. Thorough flight planning can contribute immeasurably to the all-around safety, comfort and success of any flight and to the task of preventing aircraft accidents.



Flying Safety on the Airways

AIRWAYS ARE the highways of the air. An airway is a navigable airspace extending upward from 700 feet above the ground, stretching between designated points. The administrator of the Civil Aeronautics Administration establishes airways by designating definite points, such as radio ranges and omni-stations, and then connects these points by a line of definite width to be used by aircraft in flight.

Domestic IFR traffic each year amounts to thousands of flying hours. With so much air traffic, it is obvious that definite, predetermined flight paths and procedures are vital to safety and efficiency. Airways provide identified flight paths equipped with aids to air navigation. Aircraft flying IFR within these flight paths operate at altitudes and on schedules controlled by the civil airway traffic control centers.

Airway procedures are safe procedures. They have been carefully evolved from years of flying experience. Every military pilot should understand and follow them. You owe it to yourself to insure your own safety. In addition to that, you have a grave responsibility to the government which has a large investment in you and the plane you fly. You are responsible to your crewmembers and passengers and to other pilots and planes in the air. You can protect this investment and carry out your responsibilities by learning how to fly the airways safely and by living what you have learned.

As a military pilot, you have an assigned mission. Your mission fits in with the overall Air Force mission in maintaining the desired state of operational readiness. Basically, your mission is to fly. But the sky is no longer your own.

ATC and YOU

With the thousands of airplanes that are this moment in the sky, the problem of air traffic control becomes an increasingly complex one. Firm rules must be laid down. Firm procedures must be established and adhered to by all who fly. One agency must be designated to monitor and control all air traffic regardless of whether it is civil or military. For pilots who fly the airways, these things have been done. The controlling agency is called Air Traffic Control. Its mission is to expedite the flow of traffic along and across civil airways during all weather conditions in a manner consistent with safety. The rules and procedures are complex and they can be confusing. They are written in many places and generally speaking, all of them are available to the pilot in flight.

The intent of this feature is to consolidate a lot of these points and to clarify some that have confused pilots in the past. Due to the many combinations of problems that could arise, all of them cannot be covered here. If

further study is desired, the following publications may be consulted:

- Radio Facility Charts.
- Supplementary Flight Information Document.
- USAF Pilots Handbooks.
- ANC Manual "Procedures For The Control of Air Traffic."
- ANC Manual, "Criteria for Standard Approach Procedures."
- CAA Manual, "Flight Information Manual."

As ATC does not, in most cases, have direct communications with the pilot, CAA communications facilities relay the messages. In this article, therefore, whenever a contact with ATC is mentioned, it should be understood that the radio contact will be made with a CAA communications station or an ATC Center.

The following pages will emphasize that when you're going to fly IFR on the airways, you'll be all right if you:

- Obtain a good weather briefing.
- File your Flight Plan accurately.
- Copy ATC clearances right.
- Follow the takeoff and climb instructions.
- Maintain prescribed altitudes and specified airspeed.
- Report passing compulsory reporting points.
- Use correct radio procedures.
- Follow letdown instructions.
- Know emergency procedures.
- Close out your Flight Plan.

Flight Planning

Section "C" of the DD Form 175 is transmitted to ATC and is the basis for control of the flight. The information it contains must be correct. It is important that no misunderstanding exist between you and ATC concerning the proposed route of flight specified in the flight plan. Your route may be adequately described by indicating the color abbreviation and number of the airways to be flown when on LF/MF airways. Civil airways which cross or merge for short distances with the airway being flown need not be indicated. Intermediate reporting points along an airway need not be indicated, thus "Green 5 to New York" can describe an entire flight from Los Angeles to New York. All alternating portions of VFR or IFR flight along an airway must be accurately described however, and great care must be taken to avoid confusion, especially when flying through congested areas. Compliance with the provisions of AFR 60-22 regarding ADIZ procedures is, of course, a *must.*

You can file a flight plan which incorporates both airways and direct off-airways routes, but you should define clearly an off-airways route.

Generally speaking, you will find that following airways is the best procedure. Little distance will be saved by short cuts off-airways. It is always advisable to file an IFR flight plan if VFR conditions are not assured, but a flight plan can be filed that has both IFR and VFR portions. If the first portion of the flight is IFR and the latter portion VFR, an ATC clearance will be obtained only for the first portion. If the latter portion of a flight is IFR, you will be instructed to contact a communications station to receive an ATC clearance before entering the IFR portion of the flight. Often times, varying delays will occur in filing composite flight plans, the last portion of which is to be IFR. Delays can be caused by ATC's being unable to work you in immediately or by errors in transmissions from base operations, Flight Service or others.

True airspeed is specified in the Form 175. ATC expects you to make good this airspeed, as it is used in computing the longitudinal separation between aircraft flying on the same airway at the same altitude. All speeds must be given in knots. Your flight plan should indicate the TAS you expect to make good. You must familiarize yourself with the procedures for maintaining this airspeed. Any deviation of true airspeed in excess of 10 mph constitutes a change in flight plan and ATC must be informed of the change. If it becomes apparent during the flight that the original ETE is in error, it is usually easier to file a corrected ETE than to adjust the airspeed to make good the original estimate.

You must indicate the type of airways you intend to fly. Low frequency airways are identified by a color: Red, green, amber and blue. VOR airways are identified as Victor airways by number. Aircraft on IFR flight plans must be flown at not less than the established minimum altitude for the airway over which the flight is conducted. The one exception to this rule concerns operation along a VOR airway. Minimum obstruction clearance altitudes are established between radio fixes on VOR airways which meet obstruction clearance requirements for the entire route segment, but assure acceptable navigation coverage *only* within 25 miles of the VOR station. These altitudes are published, along with minimum reception altitudes in the Radio Facility Chart. They may be used as emergency altitudes anywhere along the route segment and as a minmum en route altitude within 25 miles of the station. The flight plan must indicate the even or odd thousand-foot altitude above sea level that is appropriate for the direction of flight along civil airways.

Even-Odd Rules

ATC may and does clear aircraft to operate at altitudes different than that indicated in the Radio Facility Charts. For example, the Chart indicates that traffic flying northbound on Amber One will operate at "Odd" altitudes. Normally, all traffic will. When necessary, however, ATC may specify that certain aircraft will operate at an "even" altitude northbound. Thus, a pilot flying in VFR conditions, following the "Even-Odd" altitude indicated in the chart might find himself on a collision course with another aircraft legally operating at the same altitude flying an opposite direction.

Knowing that this can and does happen is especially important when flying the airways at night. The separation that is desired and implied by the "Even-Odd" rule cannot be assumed to exist in VFR conditions.

When you request a "1000 feet on top (10/otp)" clearance, you are expected to fly the altitude prescribed (odd or even) for flight along civil airways, except when operating above 29,000 feet. In such cases, odd thousand-foot levels must be used unless specific ATC clearance has been obtained. This applies also to aircraft flying VFR at 3000 feet or more above the terrain. These altitudes are not always the same as the quadrantal separation altitudes for off-airways flights, especially on southeasterly and northwesterly headings. It is your direct responsibility to avoid other traffic when flying under VFR conditions even if your flight is being conducted on an IFR clearance at an assigned altitude. Flights cleared by ATC to operate 1000 feet on top may operate *between cloud layers* provided VFR weather conditions exist between the layers. Normally, on-top clearances will contain information on the reported tops. When aircraft capabilities will not permit climb to the top, an amended ATC clearance will be requested. All flights cleared to operate on-top must fly at or above the minimum en route altitude.

Generally, on Green and Red airways, and on even numbered VOR airways, east-bound flights should be conducted at odd thousand-foot altitudes, westbound at even thousand-foot altitudes.

On Amber and Blue airways, and odd numbered VOR airways, northbound flights should be conducted at odd thousand-foot altitudes and southbound flights at even thousands.

The following rules apply on segments where color airways and VOR airways overlap:

- Where a color airway coincides with a VOR airway, the odd or even rule for the appropriate color airway will apply.
- Where no color airway is involved and even numbered and odd numbered VOR airways coincide, the rule for even numbered airways will apply.

NOTE: These rules are the basis for requesting en route altitudes on IFR flight plans. If possible, when flying "at least 1000 on top (10/otp)", you should conform to the above altitudes. These rules will apply although forward flight visibility is unlimited.

ATC Clearance

Before takeoff, the tower will obtain your ATC clearance. It will be relayed to you and you should be prepared to copy the clearance quickly and accurately. It should be read back to the tower to eliminate any misunderstanding. It is always good practice to check the clearance against the flight plan on the duplicate copy of the Form 175 and note any variations. Some pilots make a copy of the expected clearance prior to receiving it, then make the changes.

Most clearances will include climb instructions such as "climb on course," "climb on a heading of 150 degrees," and some clearances may even include the direction of takeoff as "take off southeast, right turn after takeoff, climb on a heading of 270 degrees, report when reaching 1000 on top." Usually, these instructions will be issued by word description, but at several major terminals a system of coded departure routes has been initiated. You should study the possible routes of departure while planning your flight to eliminate delay and confusion after receiving your clearance.

Climbing instructions will occasionally specify a somewhat devious route of departure but these routes are the only possible method of expediting arrivals and departures at busy terminals. VFR flight may be specified in climbing instructions, such as "climb VFR" or "maintain VFR for five minutes on a heading of 225 degrees before starting climb." It should be noted, however, that VFR departures will be given only when you indicate in the Form 175 that you will accept a VFR climbout.

In the event the clearance for all or any portion of the flight is identical to the route you have filed, the term "via flight planned route" may be given by the controlling agency. When used, this phrase will be preceded by sufficient detailed route of flight information to get the flight on the filed route. It is important to remember that this clearance phraseology *does not include* approval of altitudes filed in the flight plan. Specified altitude assignments will be issued in each clearance.

The initial clearance will normally authorize flight to the point of intended landing, but in some cases the clearance will be to some intermediate point due to traffic conditions. In such case, the clearance for the remainder of the flight is usually received before reaching the intermediate point.

In the event that you arrive at your clearance limit without having received either a clearance beyond, or holding instructions at this fix, you are expected to begin holding in a standard race track pattern. You should hold on the course on which you approached the fix, maintaining the last assigned altitude. You should also request further instructions immediately through the nearest air/ground station. Your altitude at this clearance limit will be protected so that separation will exist in the event you do have to hold at this point.

Position Reporting

The safety of all planes in the air and the effectiveness of ATC depend on accurate position reporting by pilots. To provide proper separation and to expedite the movement of aircraft, ATC must be able to make accurate estimates of the progress of every aircraft operating on an IFR flight plan. Unless you make all required position reports promptly and accurately, it is difficult for controllers to compute your actual and future positions, with the result that traffic conflicts cannot always be accurately foreseen. An error in position reporting can result in delays,

During your flight planning, you will find that flying the established airways is generally best.

1.	Identification: (The last five digits of the aircraft's serial number preceded by the service designation and jet, if applicable.)	**Air Force (Jet) 19890**
2.	Position:	**Litchfield**
3.	Time:	**Five Six**
4.	Altitude:	**Eight thousand**
5.	Type	**Instrument Flight Plan**
6.	ETA over next reporting point:	**Pullman, One Eight**
7.	Name only of the next succeeding reporting point along the route of flight:	**Milwaukee**
8.	Remarks	

Instrument Flight Rule position reports must include this minimum essential information.

or in separations which are less than the required minimum.

To insure accuracy, check your aircraft clock before each flight and the time of passing a fix given to the nearest minute. Be careful to identify the reporting point correctly. When an aural or visual indication is used to determine the time of passing a reporting point such as a fan marker, "Z" marker, cone of silence or the intersection of two range legs, the time should be noted when the signal is first received and again when it ceases. The mean of the two times should be taken as the actual time over the fix.

On an IFR flight plan, make position reports as outlined on the back cover of the Radio Facility Charts. Compulsory reporting points are depicted by solid triangles in the Radio Facility Charts. Non-compulsory points are shown as outlined triangles. Another symbol consisting of a black triangle with a circle inscribing the letter "L" attached indicates that a position report is required below 15,200 feet but not above.

Present requirements for position reporting are that on a VFR flight, a position report is made at least every 60 minutes or 200 nautical miles. On an IFR flight below 17,200 feet, reports are made over compulsory reporting points and as requested by ATC. On an IFR flight above 17,200 feet, you should report over fixes named in the flight plan and as requested by ATC. These reports will be made at least every 60 minutes or 200 nautical miles, whichever is less. Under either IFR or VFR conditions, you are required to maintain a listening watch on a CAA frequency. On an IFR flight, you must notify ATC before changing to another frequency.

All position reports should be preceded by an initial call to establish contact. The last five digits of the aircraft's serial number, preceded by the service designation (and the word jet, if applicable), should be used for the initial call.

Position reports should be made as soon as possible after passing a fix but it is not necessary to report when directly over the fix. Before initiating the call, the time should be noted, the estimate for the next fix computed, and the radio monitored to avoid breaking in on another conversation. Exact time over the fix is the time given in the report, hence the importance of setting the clock accurately. The position report contains estimated time of passing the next reporting point along the route of flight. If you see that this estimate will be in error by more than three minutes, relay a corrected estimate to ATC.

IFR position reports must include the information contained in the boxed illustration above. (Bold type indicates actual phraseology.)

All superfluous words are eliminated to save time. The required information should be given in proper sequence. Don't talk too fast. Allow the range station operator time to copy the report accurately. The ground station designation, "Washington Radio; Shreveport Approach Control," and so on, may be deleted after contact is established.

The CAA station will receive and file VFR position reports received from you. They will also receive and transmit to Military Flight Service Centers inflight changes which are of operational interest to either flight service or air defense. CAA stations will transmit flight advisories as requested by Military Flight Service. These will include "flash advisories."

Change of Flight Plan

Any change from the original IFR clearance must be approved by ATC. You may change from IFR to VFR by informing any communications agency that has direct contact with ATC that you are canceling your instrument flight plan at a stated time.

VFR Flight Plan. When you want to change your route or point of first intended landing on a VFR flight plan en route, contact a CAA communications station or military communications facility. Submit the change in accordance with the outline on the inside back cover of the Radio Facility Charts.

Change of IFR Flight Plan or VFR to IFR. To change a flight plan en route you must obtain a clearance from ATC through a CAA communications facility. The facility obtaining the traffic clearance will notify Flight Service of the change only if requested.

When a change of destination and/or route is desired, you should make a normal position report followed by the details of the requested change in flight plan.

If you want a change in altitude, make your request immediately following a normal position report. If an emergency exists (icing conditions, loss of power and so on), make your request and give only the information required. To get immediate action on such a request, you must "Declare an Emergency." Don't wait until it's too late. If your declaring an emergency causes ATC to alter traffic, they will request a report. If no traffic is involved, no report will be necessary. The inside back cover page of Radio Facility Charts contains information on what data must be transmitted in requesting a change in flight plan.

Closing Flight Plan. At locations with an established military base operations, you must close your flight plan with base operations upon landing. At non-military installations, close your flight plan with the nearest Flight Service Center by interphone "drop" line, if available. At "P" fields with the CAA facility after landing, or at "PC" fields this can be done through the nearest CAA Radio station before landing. If you are unable to close your flight plan by any of the above methods, call Flight Service by long distance telephone, collect.

Holding

Holding is the flight path made by an aircraft with a definite time, heading and altitude relationship to a prescribed fix. Some holding is required on nearly all IFR flights. To follow the standard holding flight path, fly the specified course inbound to the holding fix, make a 180-degree, one-needle-width turn to the right; fly a parallel course outbound from the holding fix for two minutes, correcting for known drift; turn 180 degrees to the right and again follow the specified course inbound. When holding at an approach control fix and instructions are received specifying the time of departure from the fix, you should adjust your flight path so that you may leave the holding fix at the specified time. This you can do by shortening or lengthening the legs of the holding pattern as required. A procedure turn need not be executed, as the aircraft may proceed to the new fix or to the final approach directly from the holding pattern. All turns required in connection with entry or exit from a holding pattern should be made on the same side of the prescribed course as the holding pattern.

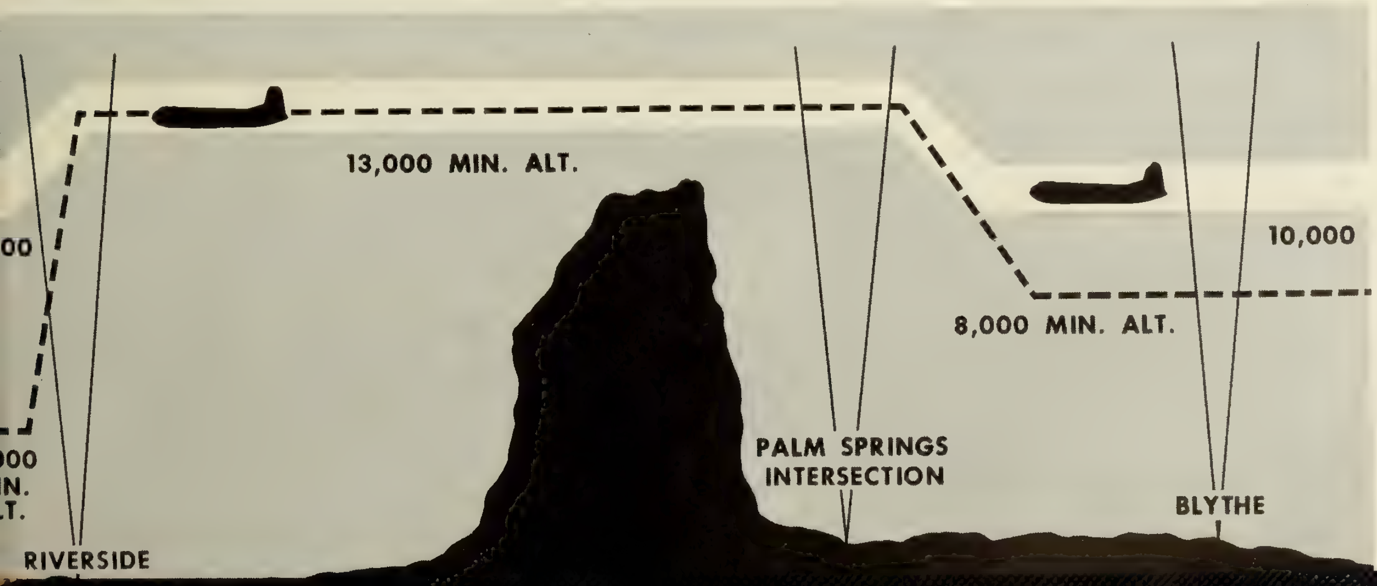
You will be expected to adhere as closely as possible to the assigned holding pattern. If at any time you are requested—or for any reason it becomes necessary for you to hold at a speed greater than 180 miles per hour (155 knots), notify ATC. Holding pattern buffer zones are established for this speed, and separation is predicated on the assumption that no one will exceed 180 mph in the holding pattern. Generally speaking, arrangements are made so as to double the dimensions of the holding pattern airspace for jets when holding between 19,000 and 29,000 feet and triple the dimensions for holding above 29,000 feet.

Due to the location of facilities in congested areas and in order to expedite air traffic, non-standard holding patterns are used at some locations. These non-standard pattern are depicted on Radio Facility Charts. Clearances for holding in non-standard patterns will contain a brief description of the non-standard features of the pattern. Absence of instructions regarding the direction of turns will mean that right-turns should be flown. Absence of instructions regarding the length of the patterns will mean that two-minute legs should be flown.

A clearance for holding in a right-hand, one-minute pattern will only contain the length of the pattern, i.e., "one-minute pattern." A clearance for holding in a left-turn, two-minute pattern will only contain the direction of turns, i.e., "left-turns." A clearance for holding in a left-turn, one-minute pattern will contain both the direction of turns and length of pattern, i.e., "left-turns, one-minute pattern."

Holding instructions will include the expected approach time to allow you to plan a course of action. If you are issued instructions to hold at a point en route and no expected approach clearance time is issued, the holding clearance will contain a time limit, using the phrase "Expect Further Clearance at (time)."

An aircraft cleared through Blythe to Los Angeles to cruise and maintain 10,000 feet until further advised, loses his transmitter before reaching Blythe. Proceeding on course he maintains 10,000 feet until reaching Palm Springs, where he climbs to 13,000 feet (the minimum altitude). After reaching Riverside, he immediately descends to the original altitude.



Approach Clearance

Approach Control. This is a service whereby specified CAA and military control towers direct IFR flights arriving at, departing from, and operating in the vicinity of airports, by means of direct communications with all aircraft under their control.

Approach control is the controlling authority in a zone which usually consists of one or more airports and its approach and departure instrument flight patterns. Approach Control towers are responsible for providing separation between departing aircraft and all other aircraft under their jurisdiction. The clearance to departing aircraft includes the clearance limit, including altitude, route and other control. Time of takeoff, direction of turn, altitude restrictions after takeoff and other specific restrictions necessary to effect separations from aircraft under its jurisdiction are determined by approach control. The time of takeoff is specified in the ATC clearance only if necessary to coordinate the departure with traffic not under approach control jurisdiction. A "clearance-void-time" will be specified by the ATC center if a delayed departure would result in conflict with traffic not released to tower control. A "clearance-void-time" determined by the tower will never be later than that issued by the ATC center. Close coordination is essential between approach control and the ATC center and is maintained to prevent traffic conflict. After coordination with the tower, a center may clear arrivals to hold at holding points until advised by approach control.

Limit of Clearance

An air traffic clearance from an Air Traffic Control Center ordinarily clears aircraft on IFR flights to a holding point. This is normally a radio range station, ILS outer marker, fan marker or other radio fix and is used as the limit of the ATC clearance. Instructions to hold may be included by the Air Route Traffic Control Center and they will tell you on what frequency to contact approach control when you arrive over the holding point.

You should not contact approach control until over the specified holding point unless directed to do so. The Air Route Traffic Control Center will tell you when to contact approach control or where. Approach Control will usually issue the approach clearance for an instrument approach to an airport. An approach clearance is usually good for one approach, only. This approach may be either a standard range approach, ADF, GCA or ILS approach or combination thereof and will be specified.

Approach Sequence

Each pilot in an approach sequence will be given advance notice as to the time he should leave the holding point on approach to the airport. When the time of leaving the holding point has been received, you should adjust your flight path to leave the point as closely as possible to the designated time. On receipt of a fixed departure time, use up the intervening time in holding flight by adjusting your path within the limits of the established holding patterns so as to arrive over the fix inbound at precisely the specified time or as soon thereafter as possible.

The pilot's timing calculations are relatively simple and are based on the fact that a 180 degree turn should use up one minute of flight time. Thus it is possible to vary the holding pattern time with precision. Experience in using these procedures indicates that with a little practice, pilots can consistently cross the fix inbound within 20 seconds of the specfied time.

Missed Approach

In the event landing is not completed after one standard instrument approach, follow the standard missed approach procedure (outlined in the Pilot's Handbook) or advise the traffic controller of your intentions and receive further clearance. If you want to make a second approach, Air Traffic Control will determine whether you will be cleared for another *immediate* attempt. You may be directed to stand by on a designated leg of the range at an assigned altitude until another aircraft in line has landed or taken off. This decision will be based upon existing traffic conditions unless an emergency traffic condition exists. A decision to go to an alternate airport must be made by you and clearance to the alternate airport must be obtained.

The minimum ceilings and visibility requirements for instrument approaches are listed in the Pilot's Handbook. When weather is below the landing minimum and you decide to hold for improvement in weather, Air Traffic Control may direct you to proceed to an adjacent holding point or to a position higher in the approach sequence. Here is an important point. When your flight plan is transmitted, the alternate airport you have speci-

ALTIMETER SETTINGS

Civil Air Regulations prescribe that flight altitudes shall be in feet above sea level. Accordingly, altimeters should be set to the current setting of the nearest station reporting official altimeter settings along the route of flight. All altitudes used in connection with the control of air traffic are based on indicated altitude, since any temperature error will affect all altimeters in the same vicinity and relative separation between aircraft will be approximately maintained. Pilots should consider temperature error only with respect to insuring that actual altitudes of the aircraft permits ample clearance of terrain and obstructions.

fied is not included in the transmission. Therefore, ATC will not know the alternate you've selected and have therefore made no clearance arrangements for you from your original destination to that alternate. This means that if you must proceed to your alternate airfield, under IFR conditions, you must obtain a further ATC clearance to the alternate destination. This, of course, is not necessary if the flight does not involve airways.

Compulsory Reports

The following reports should *always* be made to Air Traffic Control:

- The time and altitude of reaching a holding point or the point to which cleared.
- When vacating any altitude for a newly assigned altitude.
- The time of leaving an assigned holding point.
- When an approach has been missed.
- Jet Aircraft report over final approach fix (low cone).
- When visual reference to the ground is established.

The following reports should be made *when requested* by Air Traffic Control:

- Time of starting procedure turn on final approach.
- Time over range station or outer marker inbound on final approach.
- Altitudes when climbing or descending.
- Time when reaching a newly assigned altitude.
- Any other information which may aid in the control of air traffic.

Emergency Procedures

Emergencies and the circumstances surrounding them are so varied that exact rules to be followed in all cases cannot be established. If possible, the procedures outlined in this article should be followed, but you must always use your own judgment if an alternate course of action seems to be advisable.

Emergency communication procedures using distress, urgency or safety signals are contained in the inside back cover of the Supplemental Flight Information Document.

In the event of radio failure, either transmitter, receiver or both—or inability to receive radio signals because of static, you should follow one of the following procedures:

- If operating under VFR conditions proceed VFR and land as soon as possible.
- Proceed according to the latest ATC clearance.

The inside back cover of the Supplemental Flight Information Document shows the procedures that may be used to provide radar emergency interception within an ADIZ and surrounding areas.

If you proceed IFR according to the last received and acknowledged traffic clearance and other instructions to the contrary are not received and acknowledged, you will be expected to observe the following rules. The procedure followed by ATC is based on the assumption that you are following these rules:

1. If you have received and acknowledged a clearance to the destination airport or the radio facility serving that point, you should continue flight at the altitude(s) last assigned by ATC or the minimum instrument altitude (whichever is the higher) to the radio facility serving the destination airport.

2. If you have received and acknowledged a clearance to a point other than the destination airport or the radio facility serving the destination airport, you should continue flight at the altitude(s) last assigned by ATC or the minimum instrument altitude, (whichever is the higher) to the radio facility serving the destination airport.

3. If holding instructions have been received and acknowledged, you should comply with these instructions until time to continue the flight so as to arrive at the radio facility serving the destination airport at the expected approach time last received and acknowledged. Maintain the last assigned altitude or the minimum instrument altitude, whichever is the higher.

4. If holding instructions have been received, but no expected approach time has been received, follow the holding instructions until the time ATC has specified that further clearance may be expected. Then continue the flight, maintaining the last assigned altitude or the minimum instrument altitude, whichever is the higher.

NOTE: The minimum instrument altitude referred to is the minimum established for that portion of the route over which you are flying, regardless of the direction of flight. If you have to climb to a higher altitude, higher than that assigned by ATC in order to comply with a higher minimum instrument altitude, you may later have to descend in order to comply with a lower minimum instrument altitude. In this case, you should not descend below the altitude last assigned by ATC.

Descent from the altitude maintained should start over your destination radio facility at the expected approach time last received. If no expected approach time was received, start your descent at the last estimated arrival time you specified, or as soon as possible thereafter. A full, standard instrument approach should be executed unless a VFR approach can be made. ATC will hold all altitudes below the clearance altitude open for you at the destination radio facility. These altitudes are held vacant for any unreported aircraft until 30 minutes after the last expected approach time acknowledged by you, your ETE or last estimated arrival time, or the estimated time of arrival computed by ATC, whichever is later.

If you have received and acknowledged a clearance to the tower at the airport of intended landing, you will be expected to comply with any special instructions contained in that clearance and make a normal descent for landing.

NOTE: ATC may issue appropriate instructions to be broadcast "blind" over suitable radio range facilities. Instructions will not be broadcast unless ATC authorizes such broadcast.

Upon receipt of information that an aircraft in flight within a control area or control zone has encountered an emergency which may affect other air traffic, ATC will act to give the emergency aircraft priority over any other aircraft involved.

Should it become necessary for you, while holding, to make an emergency descent through other traffic areas, you should advise ATC immediately.

Upon receipt of information that an aircraft is making an emergency descent through traffic at assigned alti-

EVER BEEN LOST?

Personnel at all communications stations are trained to assist pilots in establishing positions by:

- **(a) Visual reference to terrain features.**
- **(b) DF fix by triangulation.**
- **(c) Low Frequency and Omni-range orientation.**

tudes over the airport, ATC will immediately broadcast, or cause to be broadcast, the following:

Emergency To All Concerned
Emergency Landing at .... Airport.
All Aircraft Below .... Thousand Feet
Within ....Miles of ....Radio Range
Leave............Course(s) Immediately.

Upon hearing such a broadcast, you should clear specified areas in accordance with the emergency instructions. ATC will issue further directions through the various communications facilities immediately following the emergency broadcast.

When terrain, traffic or other factors make it impractical for you to maintain the last assigned altitude, ATC will issue specific directions.

If all radio navigational equipment should fail or become inoperative, you should climb to and maintain the emergency altitude for the surrounding area. Use DR navigation to reach an area where a VFR letdown can be made.

In an emergency situation which results in a deviation from the rules prescribed in Civil Air Regulations, Part 60, you must make an immediate report to the nearest CAA regional office. When the emergency situation results in no deviation from CAR 60, but requires ATC to give priority to the aircraft, you must make a report to the nearest CAA regional office within 48 hours. Compliance with this does not eliminate your responsibility to notify your commanding officer and the Flight Service within 24 hours of a violation in accordance with AF Reg 60-16, par 55.

Altimeter Settings

Civil Air Regulations prescribe that flight altitudes shall be in feet above sea level. Accordingly, altimeters should be set to the current setting of the nearest station reporting official altimeter setting along the route of flight. All altitudes used in connection with the control of air traffic are based on indicated altitude, since any temperature error will affect all altimeters in the same vicinity. Thus, relative separation between aircraft will be approximately maintained. Consider temperature error only with respect to insuring that actual altitude of the aircraft permits ample clearance of terrain and obstructions.

Weather Broadcasts

All airways communications stations having voice facilities on continuously operated radio ranges or radio beacons broadcast weather reports and other airway information at 15 and 45 minutes past each hour. The 15 minutes-past-the-hour broadcast is an "airway" broadcast consisting of weather reports from important terminals located within approximately 400 miles of the station.

The 45 minutes-past-the-hour broadcast is an "area" broadcast consisting of weather reports from stations within approximately 150 miles of the broadcasting station.

The broadcast consists of the local weather report and the latest available surface reports from other locations. Reports more than one hour old are not broadcast. Local winds aloft are broadcast two times daily when available in addition, the Weather Bureau broadcasts a local terminal forecast covering the next two hours. This forecast is broadcast immediately following the local weather report. If possible, you should avoid calling airway communications stations at or about 15 and 45 minutes-past-the-hour (which are the scheduled times) to request weather information. Such calls may delay starting of scheduled broadcasts and cause inconvenience to other persons who are depending on the broadcasts for weather reports.

The best way to get both current weather observations and up-to-the-minute forecasts is to use the Pilot-to-Forecaster Service provided at many Air Force bases throughout the country. The bases providing this service are listed in the data pages (Remarks Section) of your Radio Facility Charts.

When you encounter weather conditions which have not been forecast you are required to report such conditions to the closest CAA Radio Facility. Report in this sequence. (It is listed on the inside back cover of the Radio Facility Chart.):

- Any usual or hazardous weather.
- Turbulence.
- Icing, altitude encountered.
- Precipitation, type and intensity.
- Clouds, amount, type and height.
- Temperature.
- Type aircraft.

Jet Letdown

In order to standardize instrument approach procedures, the USAF, the Navy, the Coast Guard and the Civil Aeronautics Administration have published an ANC Manual, entitled "Criteria for Standard Instrument Approach Procedures." Air Force Regulation 55-24 requires the use of this ANC Manual in establishing instrument approach procedures.

The primary purpose in the establishment of the special jet letdowns was to permit jet aircraft to accomplish penetration and standard instrument approaches with the least possible delay in time and the minimum number of turns. These jet penetration procedures are established so as to provide the least interference with conventional type aircraft. They also provide for the accomplishment of jet letdowns when conventional aircraft are held on the primary fix where the jet aircraft is executing a letdown. The following criteria for jet penetration and approach has been extracted from the ANC Manual, titled "Criteria For Standard Instrument Approach Procedures. In most cases the low cone altitude and the procedure turn altitude published in the jet instrument procedure is identical to the standard range approach.

Jet Aircraft Penetration

- *Initial Penetration Altitude* — The altitude at which the aircraft crosses the radio facility for beginning the penetration and approach procedure. This altitude is established for each procedure and is normally specified as 20,000 feet mean sea level or 1000 feet on top. Although an initial penetration altitude is established, ATC may permit you to make your initial penetration from en route altitudes, providing air traffic conditions and terrain do not prevent such action.
- *Penetration Turn*—A turn made during the jet penetration procedure which will return the aircraft to an inbound heading to the radio facility being used for the penetration procedure. The terrain clearance in this turn is based upon a one and one-half degree per second turn. The published procedure will indicate whether the penetration turn is a descending or level turn.
- *Minimum Penetration Altitude*—The minimum altitude over the radio facility prior to transition to final approach. This altitude provides a clearance of at least 1000 feet above all obstructions within a radius of 10 miles of the radio facility, and five miles to either side of all penetration courses for a distance of 25 miles from the radio facility.

In those areas designated as mountainous areas, a clearance of at least 2000 feet is provided. In instances where this is impracticable for any reason, deviations have been authorized but in no case is the clearance less than 500 feet, and this only when some radio fix is along the penetration course within 12 miles of the radio facility.

A straight-in penetration without first crossing the radio facility is permissible, provided that a satisfactory radio fix is available within 40 miles on which to start descent. Descent at distances greater than this is considered en route operation. En route clearances are provided up to within 12 miles of the radio facility.

- *Initial Approach Altitude*—The initial approach altitudes when applicable, are the same as those established for the standard instrument approach procedure.
- *Emergency Altitude*—The emergency altitude will clear all obstructions within a radius of 100 nautical miles of the radio facility by 1000 feet except in mountainous areas. In these areas clearance will be 2000 feet clearance.
- *Missed Approach Procedure*—A missed approach procedure is formulated for each procedure. The recovery is normally made on a course which most nearly approximates a continuation of the final approach course. Due consideration of obstructions, terrain and other factors influencing the safety of the operation is given in designing these procedures. You will initiate the missed approach procedure:

(a) At the point where you have descended to authorized landing minimums at the specified distance from the facility if visual contact is not established;

(b) If the landing has not been accomplished, or,

(c) When directed by Air Traffic Control. Time limitations are not to be used because of the variations in the approach speed of different types of aircraft. The "specified distance" under (a) may not be more than the distance from the facility to the nearest part of the landing area.

- *Altitudes*—The altitude to which you have to go on the missed approach provides at least 1000 feet clearance above all obstructions within five miles on each side of a specified course for a distance of 25 miles or to a specified fix within 25 miles of the facility. Obstruction clearance during climb are at least equal to that required for takeoff.
- *Standard Penetration* — Normally, you should start your penetration procedure over the radio facility at the initial penetration altitude. The penetration procedures are established in the direction from the radio facility which is most acceptable, considering controlled airspace and terrain features. Start the penetration when over the radio facility or a given distance after passing the radio facility, and continue it until the minimum penetration altitude or the initial approach altitude is reached, whichever is applicable.

The penetration turn is started normally when one half of the difference between initial penetration altitude and minimum penetration altitude or initial approach altitude is lost.

When the penetration turn is completed, track on the heading to the radio facility or intercept the radio range course, depending upon the procedure specified. In either case, the minimum penetration altitude or initial approach altitude must be reached before arrival over the radio facility. The penetration procedure terminates over the radio facility at the minimum penetration altitude or initial approach altitude. If visual contact is not established upon reaching the minimum penetration altitude over the radio facility, then a straight-in approach to the airport may be started, provided the bearing from the facility to the end of the runway to be used does not diverge more than 30 degrees from the direction of that runway.

For the straight-in approach, the minimum altitude provides a minimum clearance in accordance with paragraphs (a), (b) or (c), following:

(a) Obstruction clearance of at least 300 feet will be provided when the facility is within 7 miles of the airport.

(b) Obstruction clearance of at least 400 feet will be provided when the facility is within 7 to 10 miles of the airport.

(c) Obstruction clearance of at least 500 feet will be provided when the facility is within 10 to 12 miles of the airport. ▲

★ ★ ★

Credits

Source material for Flying Safety on the Airways includes the following:

- *Radio Facility Charts*
- *Supplemental Flight Information Document*
- *USAF Pilots Handbook*

The efforts of the 1229th AACS Sq (Flight Service) in reviewing the contents of this article for technical accuracy are gratefully acknowledged.

SPLASH DEPARTMENT

An important key to flying safety is accurate flight planning. It requires many flying hours to build up a good record but it takes only one "poor" plan to wipe it out. Too often a pilot permits carelessness and inaccuracy to "sit in" on a haphazard flight plan and a decision to leap off. Here are a few briefs of some accidents where inadequate flight planning was a cause factor.

●

THE AIRPLANE—A T-Bird—with pilot and passenger, was on a night, IFR, cross-country flight between two air bases that were 1190 nautical miles apart. The pilot's ETE was three hours and 10 minutes and he had fuel for three hours and 35 minutes.

Two hours and 24 minutes after takeoff, radar contact was made with a GCI station near an intermediate air base 350 miles short of the destination. The position of the T-Bird was established as being on course, 135 miles from the station. Seven minutes later, the pilot requested a change of flight plan to land at the intermediate air base. He didn't say so but it was assumed that the reason for the request was that he was falling behind on his ETAs over the reporting points. He was told that the weather at the air base was deteriorating rapidly, with low ceilings and rain, and was advised to proceed to one of two bases (less than 200 nautical miles away) where the weather was much better. The pilot replied that he didn't have enough fuel to continue, although, at the same time, he stated he had 172 gallons remaining.

The flight plan was changed with ARTC and penetration instructions were received shortly. After the aircraft entered the GCA pattern, radio contact was maintained on "Guard" channel, since the pilot was experiencing radio difficulty. He didn't follow GCA's instructions on the first approach and another was initiated.

The second approach was controlled by search radar as contact could not be established on the precision scope. The aircraft was seen to pass over the runway at approximately 300 feet by ground witnesses and the pilot said that he could see lights through the side of the canopy but not through the windshield—evidently because of frosting. The search radar malfunctioned after this second approach and the pilot then attempted an ADF approach.

INVOLVING FLIGHT PLANNING •

As the aircraft passed over the field on the third approach, radar contact was established on the precision scope.

GCA instructed the pilot on turns to make for a close-in pattern; however, the pilot said that he would proceed to the range station outer marker homing beacon and enter the GCA pattern from that position. He said, also, that he had only 20 gallons of fuel remaining. As he started the fourth approach from the homing beacon, he reported five gallons.

The aircraft was in good precision radar contact when it disappeared from the scope after the engine flamed out from fuel exhaustion. It crashed approximately four miles from the base. Neither the pilot nor his passenger ejected —both were fatally injured.

This pilot had 1337 total flying hours, including 170 hours of instrument weather and hood time, and 142 in the T-33 aircraft.

●

THIS ONE involved a VC-47 aircraft, cleared for an IFR flight, with an ETE of five hours and 30 minutes. The fuel was listed as seven hours plus 30 minutes. During the flight, light rime icing conditions were encountered intermittently. After flying approximately three-fourths of the route and about 10 minutes before reaching one of the key check points, the pilot discovered that he was 20 minutes behind time. He contacted the control center for a change in flight plan, calling for a shorter remaining route and a lower altitude for better wind advantage. The flight from this point was estimated to be one hour and 30 minutes, and fuel, at this time, was indicated to be two hours, plus.

Light icing was again encountered, with considerable turbulence. The next check point was identified through a hole in the clouds as the radio compasses were erratic and beginning to get unreliable. Shortly after this, a climb to 7000 feet and descent back to 6000 was accomplished because of traffic.

After flying headings and ETA to the destination without getting positive radio compass identification of station passage, the pilot declared an emergency. At this time all radio contact was lost between the C-47 and ground station. A few moments later the pilot noticed lights on the ground and decided to see if he could recognize the area. He descended into a valley but didn't recognize any familiar features. The fuel quantity was becoming critical now so the pilot elected to make an emergency landing. He landed in a flat area with gear up, and the copilot received minor injuries.

●

AN L-26B, WITH ITS CREW of two, took off from home base on an administrative cross-country flight that had been planned as a non-stop to designated destination. About an hour's flying time short of destination, the fuel gage indicated insufficient fuel to continue flight, so they landed to refuel.

After the L-26B was parked, the pilots noticed that the gage indicated enough fuel that should have allowed them to continue flight. Well, anyway, the aircraft was fully serviced and they took off again. At destination, the scheduled passenger boarded the aircraft for return to home base. No fuel was added at this time since they estimated a sufficient supply for four-hour endurance with a computed time en route of two hours and 45 minutes.

The flight was uneventful—up to about 100 miles from home base, when the fuel gage again indicated a marginal reading. The crew assumed this to be a recurring error in the gage which would clear itself as it had done before. Shortly afterwards, the reading became normal.

About seven miles from home base, the pilot requested and received clearance for a straight-in approach to the runway. No sooner had he acknowledged the transmission when both engines — simultaneously and suddenly — stopped! There was no area suitable for landing so the L-26 was ditched in the river that lay in the flight path. Only one of the crew survived this ditching.

●

AN F-86E WAS ALL READY for an IFR ferry flight and during flight planning, the pilot designated an alternate which happened to be unsuitable because of weather conditions. A suitable one was therefore selected but this correction was not noted on the Form 175 until the Airdrome Officer called it to the pilot's attention.

While en route the pilot managed to get 48 miles off course so he contacted a GCI station and flight following was exercised to vector his aircraft to its destination. The GCI controller advised the pilot that weather conditions at his destination were below minimums and that the next suitable field would be his alternate. The pilot decided, however, that he didn't have sufficient fuel to divert to the alternate and elected to proceed to the destination field. Three unsuccessful approaches were attempted by this pilot before he was forced to eject. The aircraft was destroyed. The pilot (fortunately, he was not injured) had a total of 1664 flying hours and 169 were in F-86 type aircraft.

Advisory · Flash Advisory · Flash Advisor

Maj. Lewis J. Neyland, Hq AWS

SOMETHING NEW has been added to make our flying safer—another step toward proving that Mark Twain's famous weather remark isn't really true anymore.

On 1 March, the U. S. Weather Bureau and the Civil Aeronautics Administration started an experimental "Inflight Weather Safety Service" to warn us of previously unforecast, hazardous weather.

There is only one pilot I've ever heard of who has deliberately tried to fly into tornado-bearing clouds (Jim Cook of the U. S. Weather Bureau, in his P-51). Very few of us even fly into a thunderstorm or severe icing or turbulence, deliberately. Mostly we find ourselves in stuff like that as a result of a bad forecast.

Usually when we do get into one of those hairy situations we're too busy to cuss the forecaster really effectively, and when we get out, we're too thankful to care.

The fact is that if every weather forecast we received was 100 per cent accurate, most stratus clouds would probably be full of CR Terror and me, getting in our 60-2 time. I won't belabor the point but if you've missed the dissertation on busted forecasts, check page 3 of the October 1956 issue of FLYING SAFETY.

Next to the guy up there in the murk, the character who worries most about you and the weather is, believe it or not, your weatherman.

Pull up a chair at base weather some morning and listen to the conversation. Chances are good, if the weather is a mite ticklish, one of the night forecasters will still be hanging around on some feeble pretext or other, waiting for the pilots he briefed to reach their destinations.

There's nothing really new about all of this. I suspect the guy who made the wind forecast for Moses on his Red Sea maneuver did a bit of perspiring too. What we really need is a flight-following system so that every time we get up in the wild blue, some guy on the ground knows exactly where we are, what we're going to run into and, equally important, has the communications to get the word to us if it looks like we're headed for any trouble.

This is a far cry from the present situation where, because of personnel and communications limitations, from the minute you head out of base operations for your bird, you're on your own until the alert truck meets you at the other end. (Individual actions of weather forecasters, operations officers and flight service duty officers are occasionally successful in giving us inflight advisory messages.) Since this is just as tough a problem for civil aviation and since our ZI en route air-ground facilities are a "common system" (i.e., for joint civil-military use), representatives from the Air Force, Army, Navy, U. S. Weather Bureau, Civil Aeronautics Administration, and ATA, got together to solve the problem. They met as members of the President's Air Coordinating Committee set-up.

First, it was agreed that the newer the forecast, the better it will be. (This holds true in most everything but wives.) Further, it was obvious that with present facilities it would be impossible to advise pilots individually of every change made in the weather forecast after he took off. Therefore, it was agreed to try issuing *Flash Advisories* using the old shotgun technique to warn of hazardous, en route weather. Effective the first of March, the U. S. Weather Bureau Flight Advisory Weather Service centers (FAWS) began preparing Flash Advisories on hazardous en route weather conditions, and the

Flash Advisories

Warn of Hazardous EN ROUTE weather presently existing or forecast to occur within 2 hours:

TORNADOES	HAIL
THUNDERSTORMS	DUSTSTORMS
ICING	TURBULENCE

Widespread unexpected LOW CEILING or rapidly deteriorating VISIBILITY

STRONG SURFACE WINDS

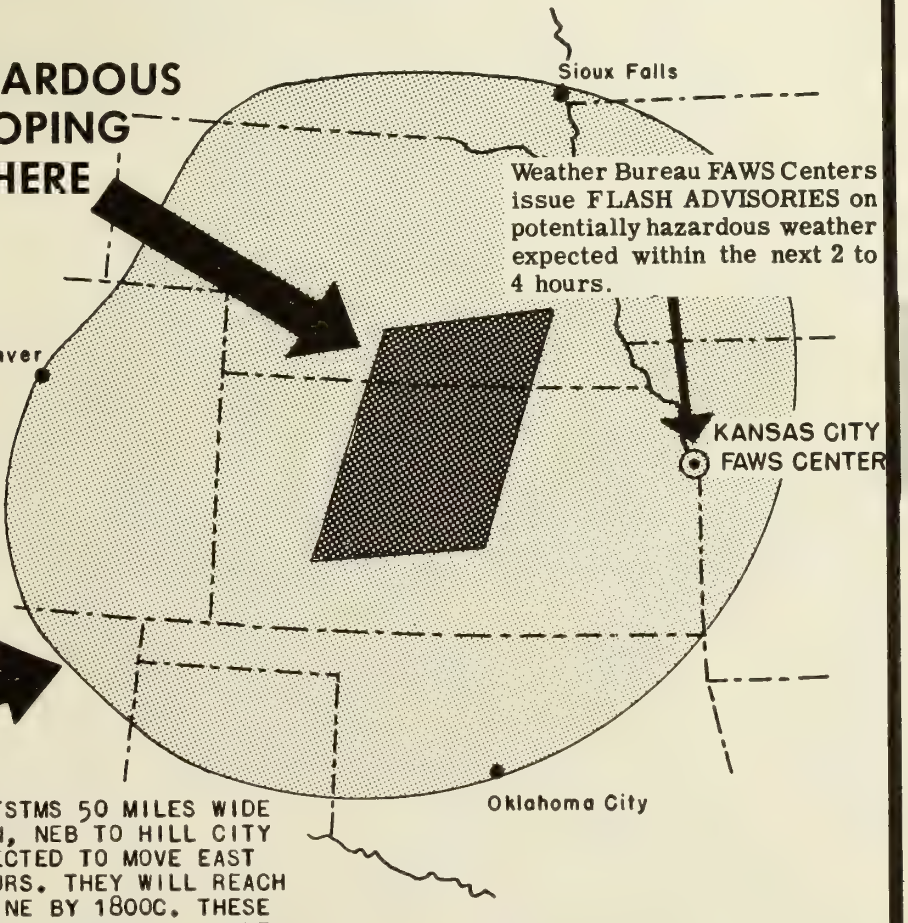
Figure 1

Example of the

WEATHER BUREAU IN-FLIGHT WEATHER SAFETY SERVICE

(Provided in Co-operation with C.A.A.)

POTENTIALLY HAZARDOUS WEATHER DEVELOPING HERE



Weather Bureau FAWS Centers issue FLASH ADVISORIES on potentially hazardous weather expected within the next 2 to 4 hours.

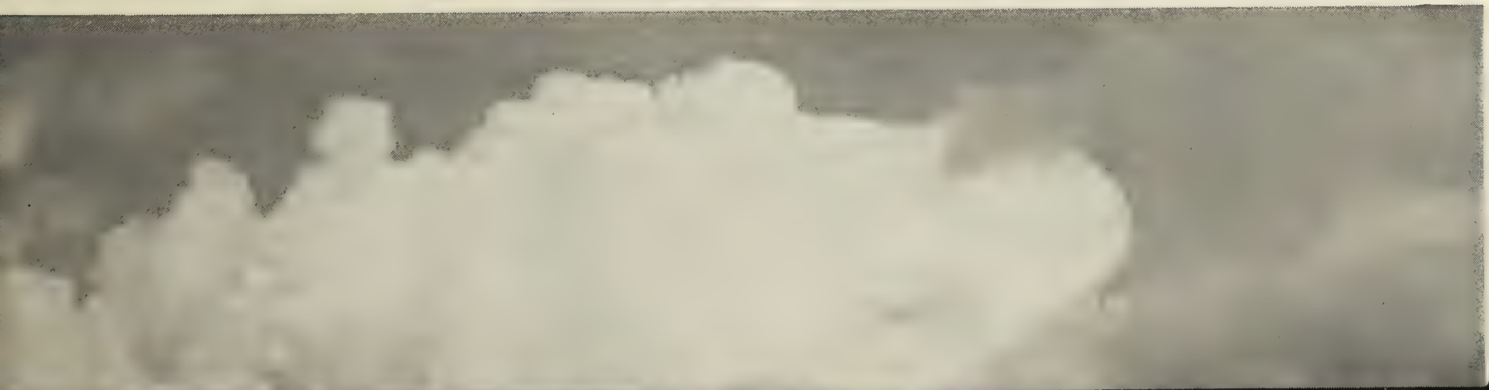
FLASH ADVISORY

(quoted below) is broadcast by all CAA stations inside this area*

"FLASH ADVISORY NR. 2. LINE TSTMS 50 MILES WIDE FROM JUST SOUTH OF LEXINGTON, NEB TO HILL CITY TO GARDEN CITY AT 1400C EXPECTED TO MOVE EAST 35 KNOTS DURING NEXT FEW HOURS. THEY WILL REACH LINCOLN-SALINA-HUTCHINSON LINE BY 1800C. THESE THUNDERSTORMS WILL BE LOCALLY SEVERE WITH HALF INCH HAIL AND SEVERE TURBULENCE."

* FLASH ADVISORIES also given enroute aircraft when radio contact is made.

U.S. DEPARTMENT OF COMMERCE - WEATHER BUREAU
Feb. 1957



CAA took on the job of getting them from the FAWS centers to the cockpit.

Here's an important point to remember: Flash Advisories pertain only to weather hazardous to en route aircraft. They make no pretense of being terminal landing advisories. The types of weather that we'll get advisories on is shown in Figure 1. (By the way, the Air Weather Service Severe Weather Warnings are considered by the FAWS forecaster when he prepares his Flash Advisories.)

A LIKELY SUSPECT...

It is important to "sound off" when you see a severe weather indication.

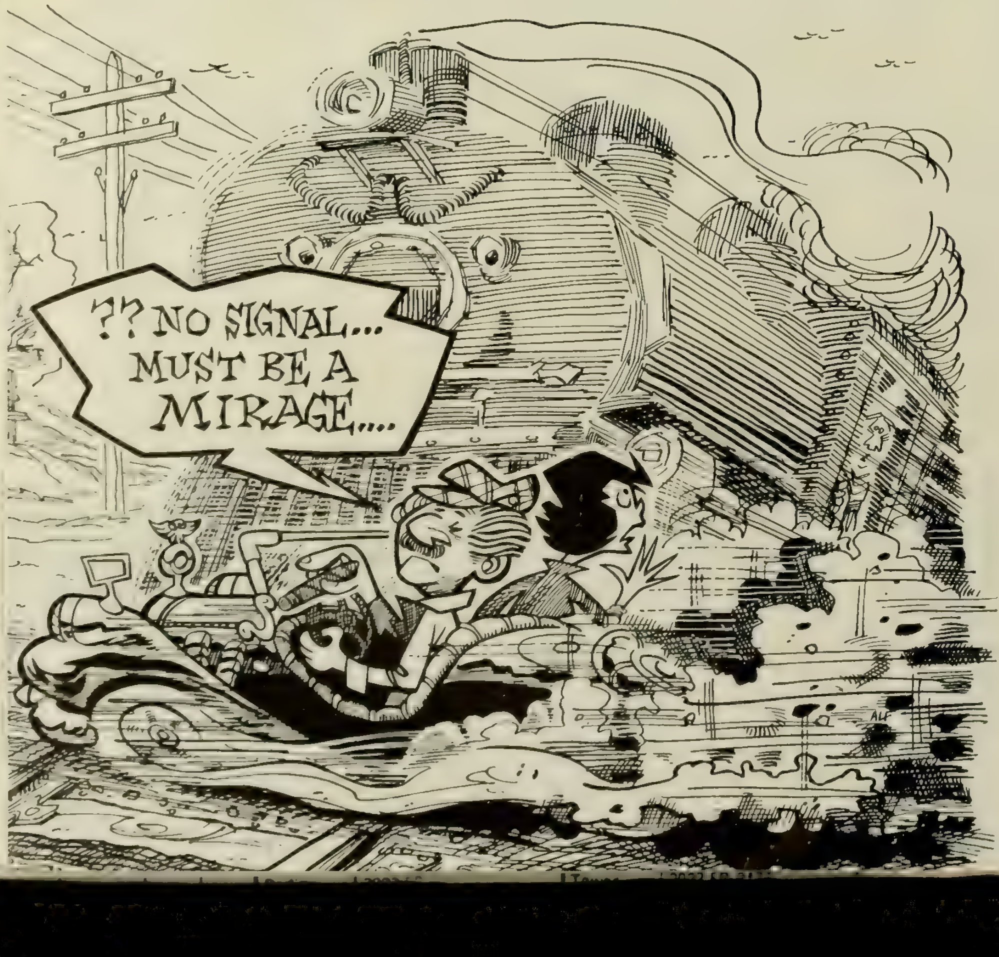
New Program

The new program works like this: When hazardous, en route weather is reported or forecast to develop within two hours, a FAWS center forecaster prepares a Flash Advisory. CAA sends the advisory to all INSAC stations within 200 miles of the hazard area. As soon as they receive the message, the INSAC operators broadcast it immediately on their voice channels. Furthermore, they rebroadcast it (on the range and VOR) as part of the scheduled weather broadcast at H+15 and H+45, and, when possible, will relay it to you when you make your position report if you're going toward the bad weather area. This continues until the Flash Advisory expires or is superseded (they will usually be good for less than four hours).

Like many of the more interesting cross-country activities, there are a few things that you need to remember about this program if you don't want to end up feeling frustrated, or worse.

First, this is not a "Red Flag" service. Don't make the mistake of thinking that "no flagman at the crossing means no train is coming." It may be *your* pilot report of moderate icing that is the first clue the FAWS forecaster has on which to base a Flash Advisory.

Don't make the mistake of thinking that "no flagman means no train."


?? NO SIGNAL... MUST BE A MIRAGE....

Second, the Flash Advisory service must help all of us—from flying flivvers to B-52s. Obviously then not all advisories will be of interest to every pilot, so if you are cruising at 50,000 feet and get an advisory of turbulence at 5000 feet, grin, man, and be glad that you're not down there.

Third, you can save both yourself and the INSAC operator a lot of time by keeping your ears open. Here's how. You remember a few paragraphs back I told you *how* and *when* these Flash Advisories were broadcast? Each is identified by the name of the FAWS center that prepared it and a serial number starting with No. 1 at midnight local time. Here are some examples:

"Flash Advisory, Kansas City number six . . ."

"Flash Advisory, Boston, number three . . ."

You can help to make the program a success by telling the INSAC operator that you have heard "Denver Flash Advisory No. 10" (or whatever other comment is appropriate) when you make your position reports. This way we can keep these things from completely jamming our air-ground channels through needless repeats.

Fourth (this is an oldie but none-the-less valid), the more pilot reports, the better the Flash Advisory service. With as many planes as there are flying within the ZI, it should be impossible for severe weather to develop without *someone* seeing and reporting it. Yet, it does.

There you are, gentlemen. One more step has been taken toward the day when no one will get caught in a weather situation he doesn't like. The Flash Advisory program has some built-in handicaps but we think it will make everybody's flying safer. ▲

No SHORT Cuts

The purpose of this tale is not to present a war story but to point out what might happen to a pilot who does not use good flight planning in preparing himself to accomplish a mission when the chips are stacked against him.

I TOOK OFF in an F-86F from Hill Air Force Base at 0900. And like the beginning of many a hairy tale, "the flight was uneventful until—."

I knew that Portland was reporting 4000 feet and five miles, which was good enough but the book says you should have an alternate for a report like that. So I picked Paine AFB—it was even better, with 5000 overcast and five miles. Things didn't look bad, but with 4800 hours behind me, I'm not one to count chickens.

This uneventful flight continued until approximately three minutes from the Portland high cone. When passing over Boise, I requested the latest Portland and Everett weather, and at that time Portland was reporting 2000 feet overcast and three miles and was not expected to get any worse. There was no change at the alternate.

Upon arriving at Portland, I was advised it had gone to ceiling zero and visibility 1/8 mile in blowing snow and freezing rain. I realized immediately that landing there would be impossible so I turned towards my alternate. I requested the weather at Paine AFB but because the sequence was garbled I was told to standby.

At this time I continued north towards my alternate and when approaching McChord, I decided to try a letdown there, weather permitting. I was advised that McChord had 300 feet, one mile and no GCA.

As I was approaching Seattle, I was advised that my alternate (Paine) had gone to 100 feet obscured and 1/4 mile in blowing snow and freezing rain. I requested information immediately regarding another alternate in the area. (In the back of my mind, I had mentally calculated my fuel requirements to return to Boise, Idaho, just in case a landing was not successful at any other field in the immediate vicinity.) I was advised that Whidbey Island Naval Air Station had 300 feet overcast and one mile visibility and light snow. I decided that I'd have enough fuel to make one approach at Whidbey Island and still be able to pull up in the event of a missed approach and return to Boise.

As I approached Whidbey Island, I was advised that a Navy R-5-D was in the GCA pattern and I would be cleared down as soon as he landed; however, that Navy plane had previously missed two approaches while attempting a GCA. It occurred to me then that the weather certainly couldn't be as good as reported since this transport type aircraft had missed two approaches. Finally I was advised that the R-5-D was on its final and I'd be cleared to start peneration. Penetration was commenced and when approaching procedure turn altitude, I was advised that the Navy transport had crashed on the runway and I would have to divert.

I knew then that my only other alternative was to return to Boise which I knew to be clear because I had flown over the area previously. I immediately initiated the climb to altitude; however, this was a case where it was better to level at 30,000 feet and capitalize on the existing tailwinds rather than use the extra fuel to climb to 40,000 where the winds were better.

I remained at 30,000 feet on a direct heading from Seattle to Boise. By this time I was in the soup and unable to receive any assistance on my radio compass. I knew my exact position, however, and the approximate heading. I flew time and distance until I was able to pick up the Pendleton, Oregon, range station. A bit of calculating indicated that I would be able to make a successful landing at Boise. I had further anticipated what I would do if I lost my radio compass or was unable to receive any signals. I knew that the ceiling from Pendleton to Portland was not below 20,000, and the height of any mountain in the United States is not over 14,800 feet. In view of these facts, I could make a successful penetration to get below a cloud layer and find myself by pilotage. This last recourse was not necessary, however, as all radio facilities came in loud and clear, and a successful landing was made at Boise. ▲

This narrative can certainly point out to all pilots, regardless of experience level, what can occur when circumstances start to snowball and the mission cannot be accomplished as originally planned. This demonstrates the need for good sound flight planning—with no short cuts.

. . . even high-flying jet jocks should look for the SPEED SIGNS

Capt. Robert A. McCauley
509th Fighter-Bomber Sq
Langley AFB, Virginia

THE JET STREAM could someday be a lifesaver for you. This would be more probable under combat conditions but it could conceivably come your way during peacetime, should you be in an outfit which realistically practices tactical training. Say, for instance, you're on one of those long range overwater navigation missions with aerial refueling, and it so happens that you can't find your tanker or—because of a malfunction—you can't take on fuel. It would be a shame if you were sitting under a jet stream with all the signs and didn't know it.

You—in your snug, little gold mine—don't have a free air temperature gage so you can't pick out the telltale temperature gradient (maximum westerly winds are located immediately on the warm side of the front). And you don't have the new APN-66 and APN-82 radars which use Doppler effect to permit radar tracking. But you do have a pair of eagle eyes and ample gray matter to look for, to find and evaluate *The Speed Signs.*

As I see it, you have six clues (visible or physical) which will help you locate the core or bore of the jet stream. The actual value of each factor might vary to some degree, depending on your flight altitude. I shall try to cover all the factors in such a manner as to permit easy and complete understanding. Your clues are:

- Haze Layer.
- Contrails.
- Cloud Types.
- Sky Color.
- Fluctuations of Airspeed Indicator.
- Clear Air Turbulence.

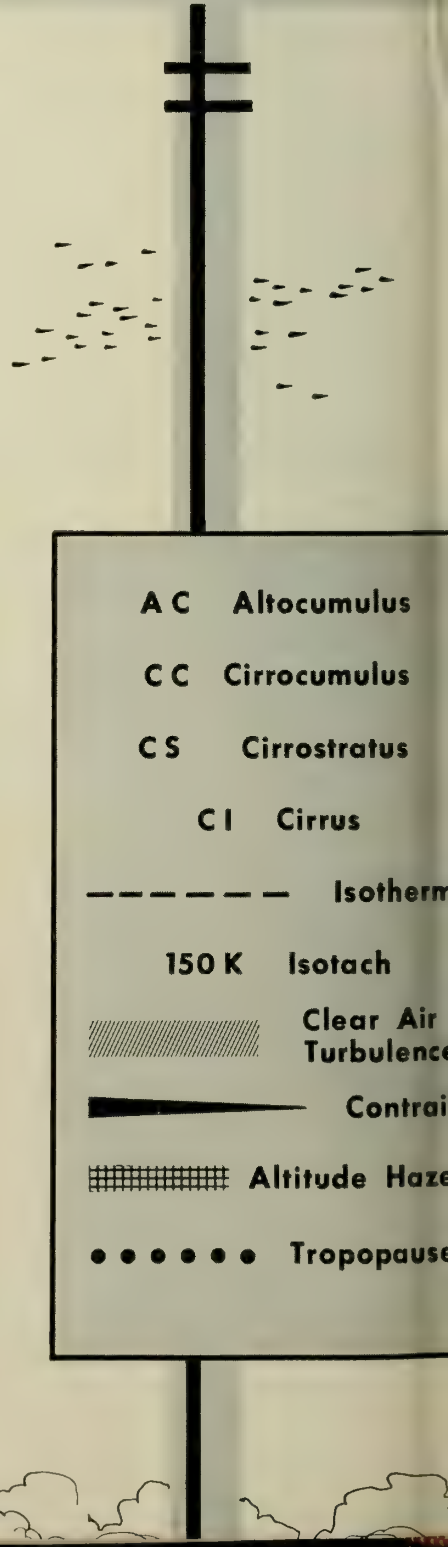
(The illustration should help you visualize what we are discussing. Remember that for the sake of simplicity and presentation, this cross-section contains all possible clues. The real thing doesn't necessarily have such a "pat" arrangement.)

Altitude Haze

This obstruction to visibility occurs near the top of the troposphere and greatly restricts the horizontal visibility but leaves vertical visibility unimpaired. As with contrails, altitude haze disappears when the tropopause is penetrated, indicating that it results from a collection of pollution particles trapped at the top of the tropopause. It is impossible to detect from surface observations. So it remains very important to remember that the full value of this clue cannot be realized until your aircraft reaches altitude. Once you are there, altitude haze can add precision to your altitude selection.

Contrails

Contrails usually start forming from 5000 to 7000 feet below the tropopause. They become more dense as the tropopause is approached, then tend to disappear immediately when it is penetrated. Their formation depends on temperature and moisture content. Notice on the cross-section how the contrail (exaggerated) thins out and disappears in area of dryer air. If this particular jet stream flows East, the aircraft would be on a heading of North. The moisture in the air, which is in a vapor state, is changed into ice crystals by agitation or addition of moisture and nuclei from combustion by-products or combinations of these.



Contrails disappear when the tropopause is penetrated. Better rear-view mirror arrangements would facilitate frequent contrail check without aircraft maneuvering. I think that a mirror rigged on the side of the front windshield near the canopy rail might be the answer.

Cloud Types

Cloud forms may provide a useful clue when properly interpreted. Four high and middle altitude cloud types frequently are associated with strong winds aloft. They are cirrus, cirrostratus, cirrocumulus and altocumulus. A rule of thumb for determining whether the jet stream is near states:

- At least three of the four basic cloud types must be present.
- The high clouds must be moving at jet stream velocities.
- The clouds must exhibit a coherent pattern extending for a considerable distance along the axis of the jet stream.

A broad sheet of feathery or tufted cirrus stretching from horizon to horizon along the path of the jet stream often can be found immediately to the South of the core.

The classic cirrus is characterized by rapid movement parallel to the course of the jet stream and by a finely barred structure with the bars perpendicular to the jet stream.

Curved "mare's tail" formations in the cirrus are cited as evidence of a horizontal line of violent wind shear just above the cloud level.

At lower levels, the jet streams are often accompanied by the lenticular (lens shaped) altocumulus clouds which usually are associated with vertical standing waves in the lee of mountain ranges. Time lapse photographs show that the clouds are actually at the crest of the waves made up of air moving at about twice the speed of the wave itself.

Cirrocumulus and billow type altocumulus also are frequently present and may stretch in parallel bands along the course of the jet stream from horizon to horizon.

The value of the cloud interpretation system is limited because sometimes no clouds develop in the vicinity of jet streams.

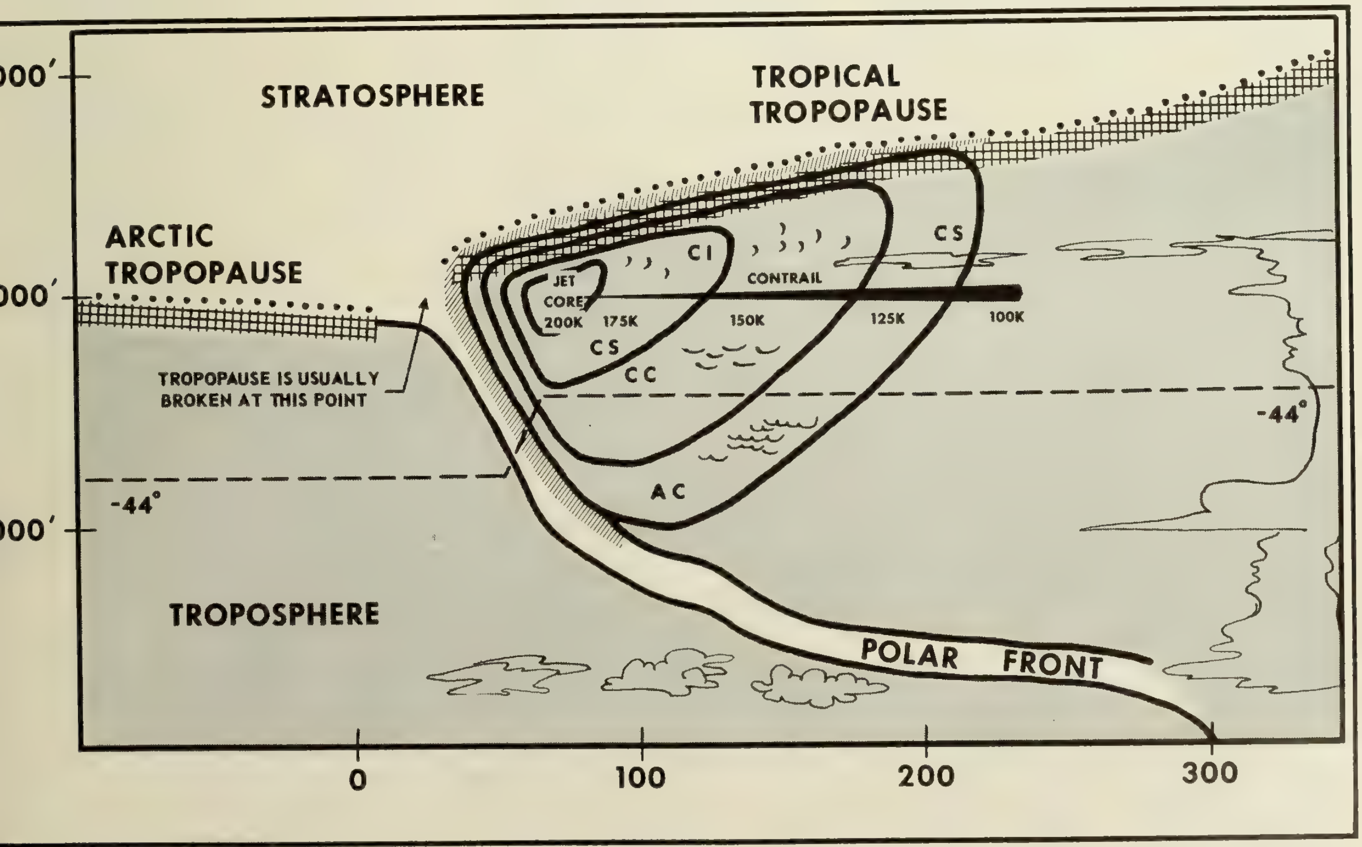
Sky Color

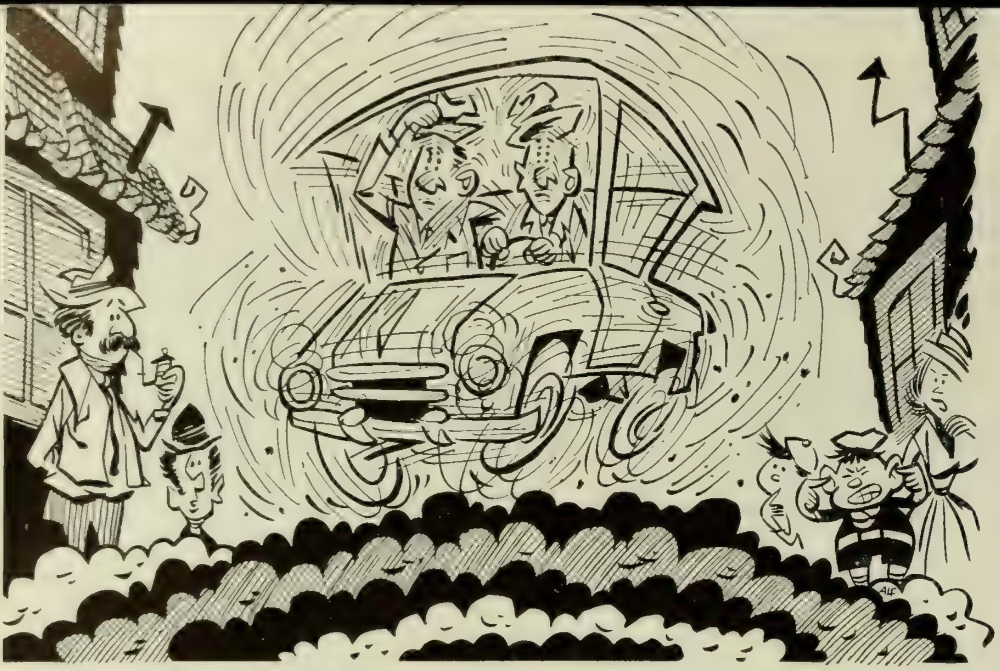
The air to the north of the core is usually perfectly clear and the sky is dark blue. Refer to the cross-section and it will be easy to see why.

Airspeed Fluctuations

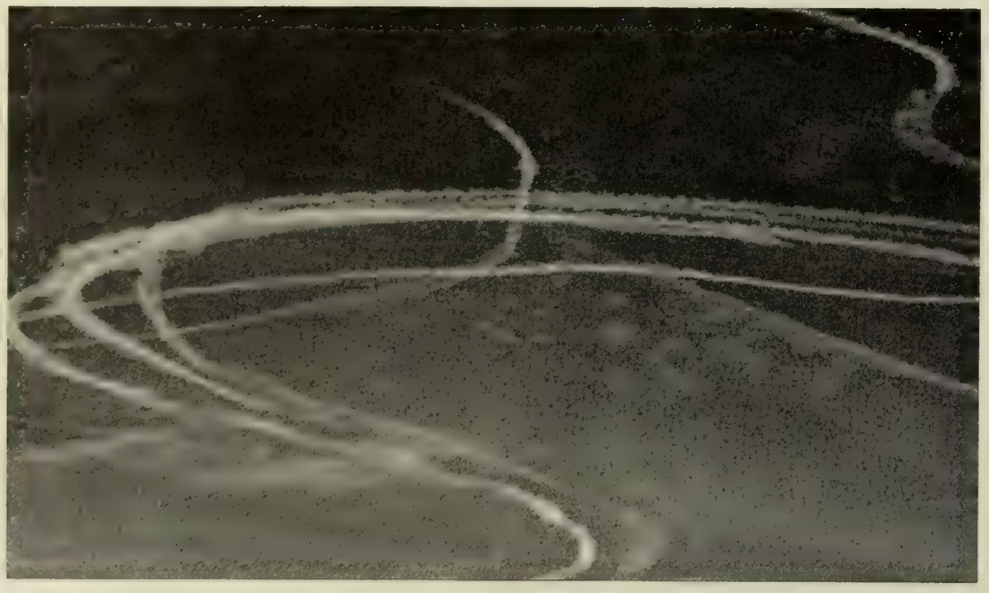
Get used to the sensitivity of your airspeed indicator needle. The advance notice that this clue could give

Notice how the core of the jet stream is situated in relation to the tropopause and polar front.





The turbulence around the stream feels like driving over a washboard road.



Contrails become more dense as tropopause is approached, then disappear.

you of nearby clear air turbulence might be worthwhile. You could include it in your instrument cross-check with no sweat.

Clear Air Turbulence

Let me use CAT for short. The best method of pilot inflight recognition of the jet stream, other than abnormal ground speeds, is the presence of CAT. This turbulence has been described in various manners, e.g., driving a car fast over a washboard or cobblestone road, as a series of irregular vibrations. CAT seldom results in a change of aircraft attitude. There is little pitching or rolling as the bumps follow one another. This is readily acceptable when we remember that we are dealing with the wind shear of an active cold front aloft. (Don't confuse CAT with any built-in buffet which some aircraft have at altitude at certain speeds.)

Wind values build up slowly across the peripheral regions to reach a maximum velocity at the center or core of the jet stream. Where the lines of equal wind speeds (isotachs) are close together, the rate of wind speed change (generally called *wind shear*) is much stronger. The wind shear is fairly severe on both sides of the jet. CAT is caused by turbulent eddies in regions of marked wind shear, that is, wherever wind velocities (speed and direction) vary sharply over short distances. Hence, it is generally associated with the tropopause and the edges of the jet stream.

Jet streams have nothing in common with jet aircraft. The name came from the similarity which exists between jet streams in the upper atmosphere and those studied for many years in hydraulics. They were so named in 1947.

Jet stream movement is most difficult to determine because the jets separate like an ocean current into smaller streams or fan out and get lost in the local circulation.

It seems ironic that even though the operational ceiling of your aircraft is getting higher and higher, the 35,000-foot level remains the best altitude for maximum jet stream winds. So don't get "steamed" if some second smoke in his T-Bird passes you up on your next cross-country. He just might know the high signs a little better than you do.

Where to Look

It is true that the maximum speed is generally found near the 250 millibar surface which is approximately 35,000 feet above sea level. Even so, jet streams have been found at all levels from 15,000 to 50,000 feet. Jet streams are believed to be a key part of the prevailing westerlies. Consequently, they are not found in the northern hemisphere north of the 70th parallel or much south of the 20th parallel. It is important that you learn the seasons for jet stream occurrence. This will depend on *where* you're flying on this globe. Check it!

Besides the gradual seasonal shift southward in summer and northward in winter of the mean position of the jet, each individual jet also exhibits a slow but definite shift southward during its life history. This shift is not necessarily steady but may be marked by periods of northward shift or by periods of almost no movement which lasts for several days or even weeks.

The jet stream is plotted by a heavy black line on the facsimile constant pressure chart for any wind velocity over 50 knots. In the weather station it is your most direct indication of possible jet stream activity. This heavy black line *only* locates *a zone.*

With the speed signs described herein, you might be able to pinpoint the jet core, or at least come closer than the heavy line.

Let the weatherman and fellow pilots in on your results, with pilot reports and/or a personal visit to the weather station upon landing. ▲

REX SAYS

TWO PILOTS of the 39th Fighter Interceptor Squadron have developed an idea which promises to reap large dividends. Captains David E. Davenport and Robert K. Milbrath, flight commanders in the F-86D All-Weather Interceptor Unit, are the pilots-turned-engineers.

The problem for which they have found an excellent solution was caused by the inclement weather. During periods of rain, snow and frost, the Dogs on air defense alert weren't provided adequate protection from the elements. Alert hangars like those found in ZI bases are not available at Komaki and standard aircraft tarpaulins were far from adequate. So, these pilots decided that a light, highly portable and economically constructed shelter was needed.

After much experimenting and planning they presented their idea to Lt. Col. Delair A. Clark, Commander of the 39th Fighter Interceptor Squadron. He gave them his full support and a test unit was constructed by the 6101st Field Maintenance Squadron.

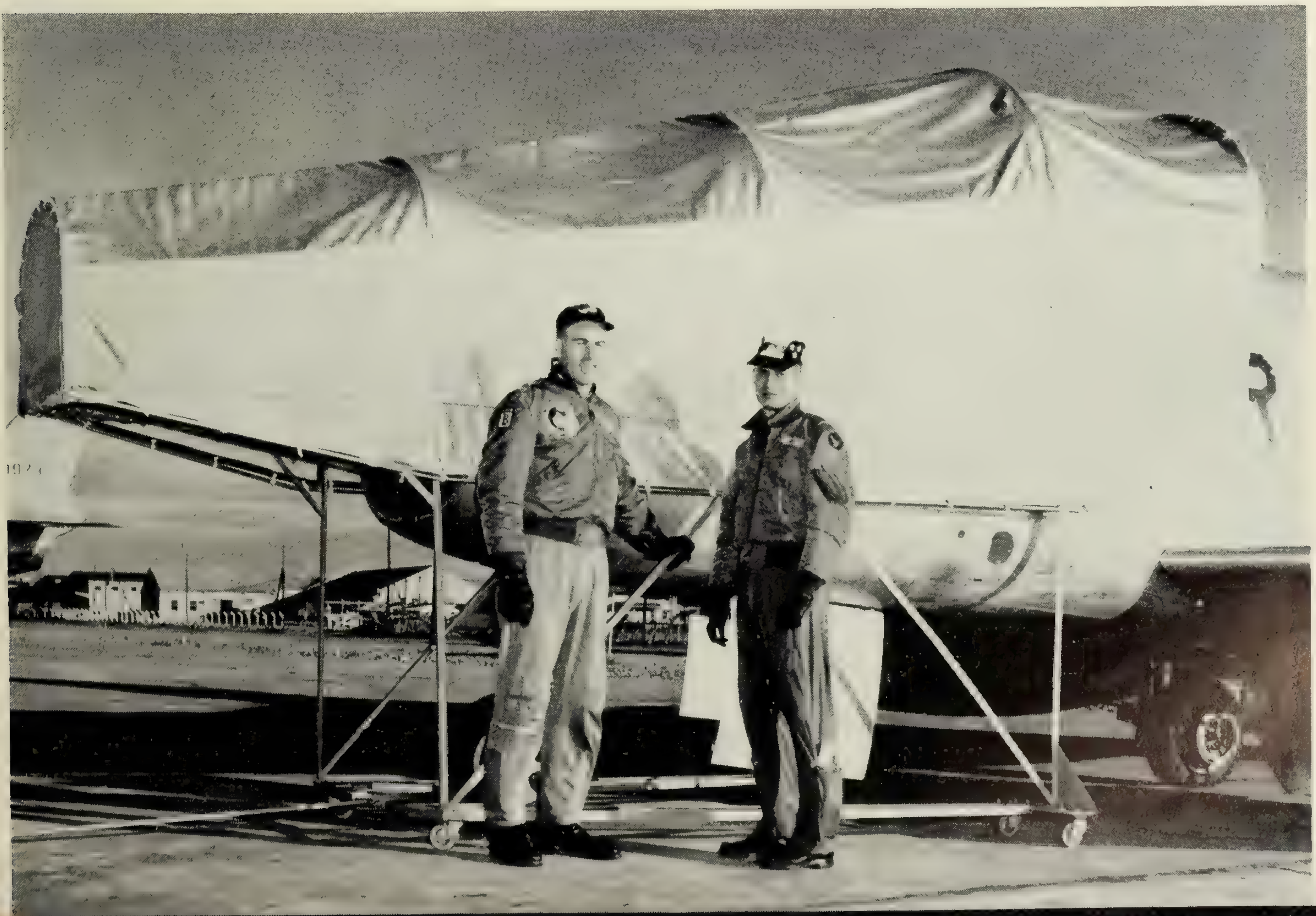
The unit is a pipe frame, covered with light, waterproof fabric, mounted on large casters. It is positioned over the nose section of the '86D, completely covering the cockpit and compartments housing vital electronic equipment. It can be put in place by one man in a few seconds.

Further testing and modification is being carried on by Captains Davenport and Milbrath in conjunction with 39th maintenance personnel. At present, more units are being constructed to provide protection for all aircraft at the alert pad.

Through their efforts, a large savings in materiel and manhours should be realized by eliminating water damage to aircraft electronic equipment.

REX SAYS*—This is a brief example of how two line pilots contributed to the Air Force effort. In this day of electronics, missiles and rocket aircraft, we sometimes feel as if our contributions are so insignificant that they are not worthy of consideration. I hope this article will erase any doubt you may have as to the importance of the ideas originated by you. Get them in the mill. The Air Force can use them.*

The two officers responsible for the protective canopy device are pictured with the end product.



TACAN is here!

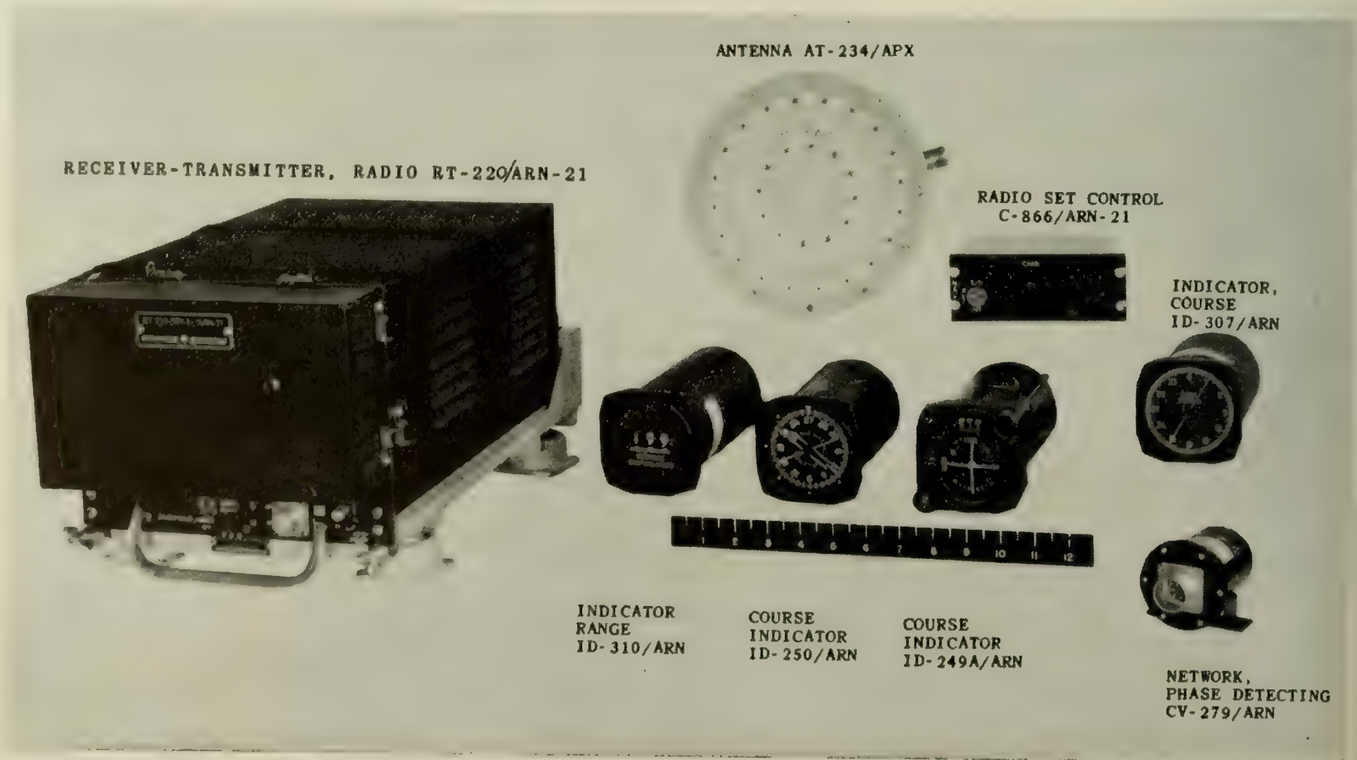
Major Robert C. Anderson, USAF

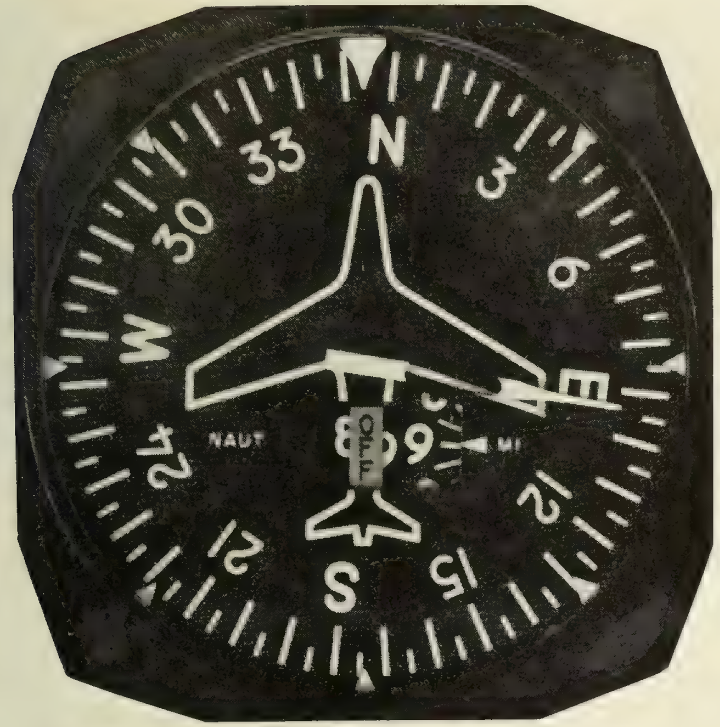
The recent adoption of TACAN by the President's Air Coordinating Committee as an element of the U. S. Common System of Air Traffic Control and Navigation marks an important milestone in the progress towards a truly "common" system. Major Anderson worked at WADC in testing and evaluating the TACAN equipment.

DO YOU ALWAYS know where you are? Have you ever said: "I was not lost—just misplaced." Has ATC ever put you in a dither by asking your position before you were ready to answer? If these questions hit close to home, perhaps the information given here will give you hope for the future.

A new navigation system is being implemented. It's called TACAN. When the word was first coined, it meant "Tactical Air Navigation." Since that time, however, its use has become more universal. It is no longer restricted to tactical use. The Air Coordinating Committee decided recently to adopt TACAN as an element of the U. S. Common System of Air Route Traffic Control and Navigation. This means that the Civil Aeronautics Administration will have the responsibility for furnishing TACAN beacons for all but purely military requirements. These CAA-furnished beacons will be coaxially located with VORs at CAA's existing or programmed VOR sites. Such a facility will be called a VORTAC and will provide distance and azimuth and VOR azimuth. The DME portion of VOR/DME, due to its frequency conflict with TACAN, will be phased out as TACAN is implemented.

Figure 1, below, shows the airborne components of the system.


ANTENNA AT-234/APX
RECEIVER-TRANSMITTER, RADIO RT-220/ARN-21
RADIO SET CONTROL C-866/ARN-21
INDICATOR, COURSE ID-307/ARN
INDICATOR RANGE ID-310/ARN
COURSE INDICATOR ID-250/ARN
COURSE INDICATOR ID-249A/ARN
NETWORK, PHASE DETECTING CV-279/ARN



The instrument shown above presents the heading, bearing and distance.

All of the possible questions regarding this system cannot be answered here; however, answers to the following will be attempted.

- What is TACAN?
- How does it work?
- What will it do for me?
- How do I use it?
- What are its limitations?
- When will I have it to use?

Many volumes of a technical nature have been published on this subject; however, our objective is to avoid gobbledegook and discuss it as it affects us in an airplane.

What is TACAN? It is a short range, omni-bearing, distance-measuring, navigation system. From the pilot's viewpoint, it is identical to the VOR system, except that the function of distance has been added. In fact, some 295 TACAN stations will be installed at the locations now used for VOR.

Figure 1 shows the airborne components (AN/ARN-21) of the TACAN system. The AN/ARN-21 weighs approximately 65 pounds and occupies one cubic foot of space. It incorporates receiving equipment for both azimuth information and distance information in one package and the results are displayed on three indicators. Of the three indicators which appear on the panel, two are very familiar (ID-248 and ID-250). The third, called the ID-310 or DME, is a new one which indicates the distance from the aircraft to the ground station in nautical miles, between zero and 200. These three instruments are planned for most USAF aircraft.

The crosspointer (ID-249) instrument is not absolutely necessary, although very desirable. Without it, bearing and distance to the station are still available, and for some aircraft with limited panel space, a new instrument will be used. This instrument, called the ID-416 (Figure 2), presents heading, bearing and distance—all on its three-inch face. As presently planned, it will only be used on space premium aircraft.

How does it work?

Like all electronic brainstorms, TACAN is loaded with tubes, resistors, condensers, and stuff like that.

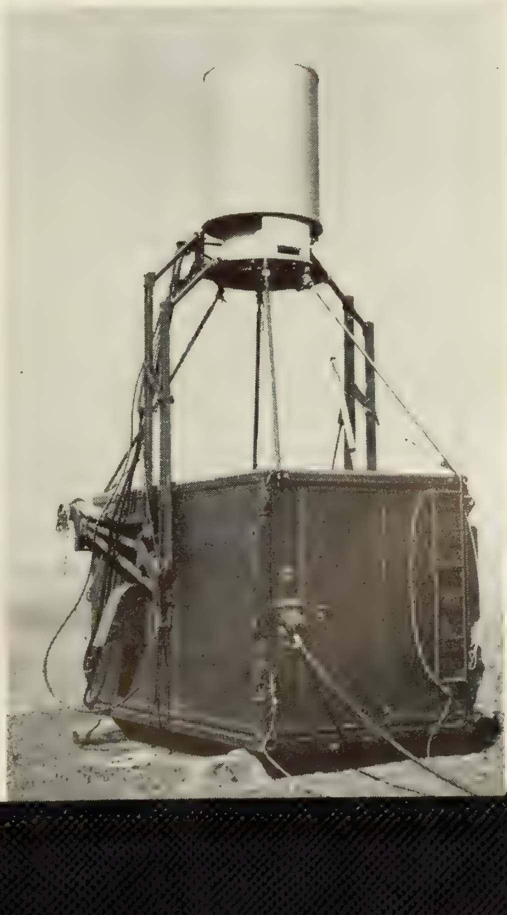
Figure 3 is a picture of the TACAN ground station. The cylinder on top is the antenna cover. Inside this cover the antenna spins at a constant speed, and radio energy is sent out in a manner very similar to the light beam from a revolving airport beacon. Suppose an airport beacon light were to blink each time it swept past magnetic north and you measured the time from that blink until the beam swept past your aircraft. You could then determine your position anywhere around the beacon. If the beacon revolved at a speed of one degree per second, and you measured 120 seconds between the north blink and your aircraft, you would be on the 120-degree radial.

The bearing part of TACAN does exactly the same thing with a radio beam, and then it presents the picture on an instrument in the cockpit.

The distance measuring part of TACAN is another time function, very similar to radar. The black box in the aircraft sends a pulse of energy to the ground station and waits for an answer. The ground station receives the query and sends an answering pulse back to the airplane. The round trip time is translated by the airborne equipment into nautical miles and presented on the instrument. Don't worry about the ground station being busy answering other aircraft. Recent tests showed that more than 122 aircraft can get answers at the same time.

What will TACAN do for me? Any time you are within range of a ground station, it will tell you your bearing and distance to it. The bearing will be accurate to plus or minus one degree, and the distance to within two-

Below, shows the TACAN ground equipment.



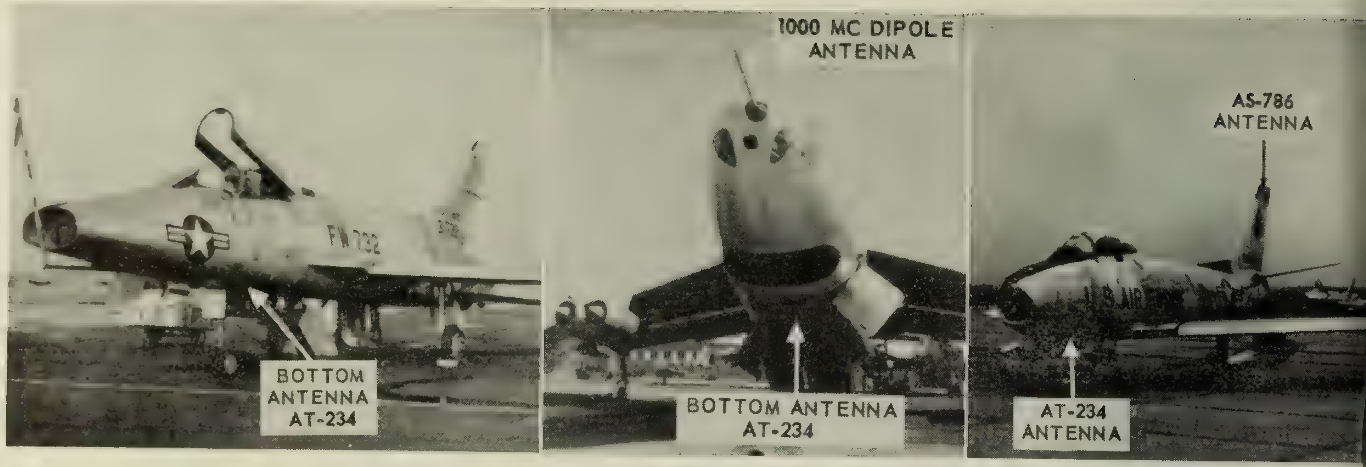
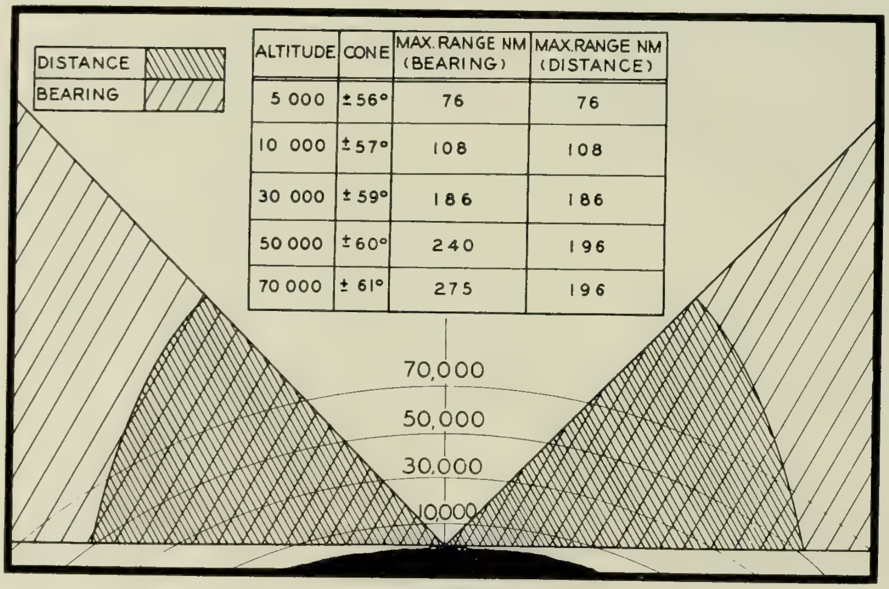


Figure 4. Above are pictured aircraft showing some of the experimental antenna locations.



ALTITUDE	CONE	MAX. RANGE NM (BEARING)	MAX. RANGE NM (DISTANCE)
5 000	±56°	76	76
10 000	±57°	108	108
30 000	±59°	186	186
50 000	±60°	240	196
70 000	± 61°	275	196

Pictured above is graphic illustration of TACAN coverage. Like OMNI, the higher the better.

tenths of a nautical mile. When ATC requests your position, you can tell them immediately and be sure that you are right. That is something!

It can be used to check radar fixes and help the radar operators identify specific aircraft. Some Alaska flyers are doing this every day. It will permit straight-in approaches from 200 miles out. It will make possible letdowns on fixes located many miles from the ground station. A computer, which may be added, permits approaches to bases with no letdown or approach facilities. Operational use will, no doubt, uncover many other uses for this system.

The next two questions, *How do I use it?* and *What are its limitations?*, can best be answered together.

Let's take an imaginary flight and explain TACAN as we go along.

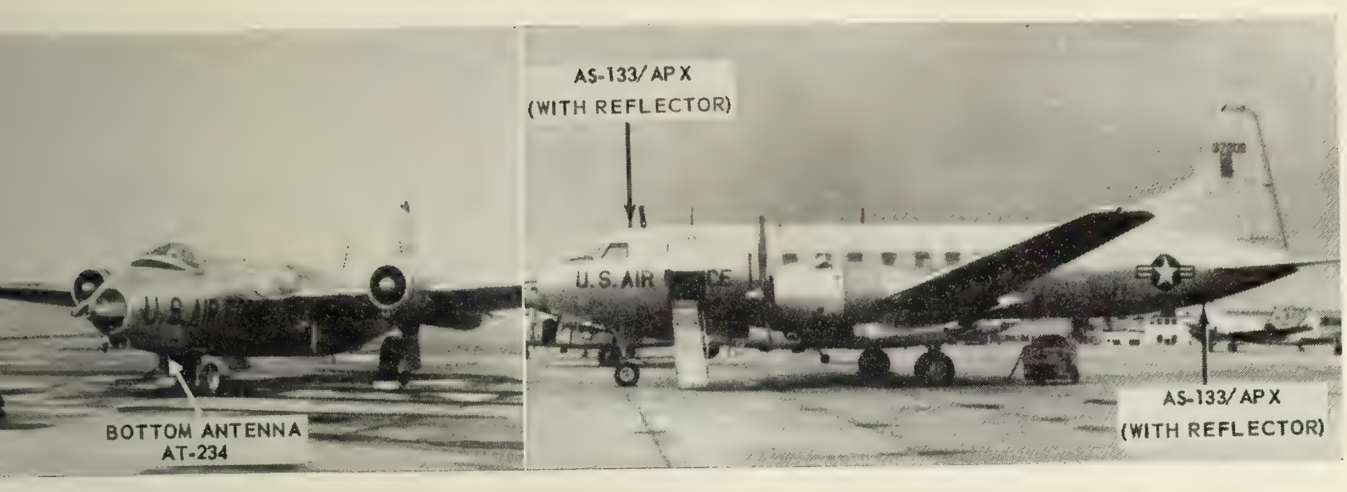
First, on the ground in the cockpit, we locate the control box. (Figure 1.) There are 126 possible channels spaced one megacycle apart from 962 to 1213 mcs. These channels are represented by number from one to 126 on the control box. From the Facility Chart we select the channel number of the station located near our base. The power switch has three positions: OFF, REC and T/R. Normally, the T/R position will be used. The REC position disables the distance function. It is used whenever it is not desired to radiate energy from the aircraft (for instance, over enemy territory).

While the unit is warming up, the number two needle on the RMI (ID-250) will rotate clockwise, the vertical crosspointer on the ID-249 will move from side to side and the DME (ID-310) will count from zero to 200 repeatedly. When the unit has warmed sufficiently, these movements will stop and the set will lock on to the station. This means that the instruments now indicate the bearing and distance to the ground station. At some locations, the set may not lock on on the ground because TACAN is a line-of-sight system. This will be the case if the ground station is shielded from the aircraft antenna by any obstruction, such as a hill, a hangar or the aircraft itself.

Figure 4 shows the experimental antenna locations used on several different aircraft. If the ground station is located on a hill and the aircraft antenna is mounted on the underside of the aircraft, there's a chance that the wing or fuselage will shield the two antennas and the set will not lock on. But in most cases it will.

Back to the flight. The set has locked on, we're airborne and climbing on course. The desired course is set in the window of the ID-249 and to stay on course, we fly to keep the vertical needle close to the center, just as we do the VOR. We're not far from course if it isn't exactly in the center but that doesn't mean that we can get sloppy. The complete sweep from full left to full right represents 18 degrees, and that means 18 miles when 60 miles out from the station. Stay close to course.

We level off at 30,000 with everything working beautifully. We're on course and the distance indicator shows an increase until it reads 196



miles, but it doesn't go any higher. No sweat, however, this is a normal quirk of the system. Even though the distance stops working at 196 miles, the course indicator continues to operate for several more miles and then everything starts to spin. This means that we are out of range of the station so we tune in the next one on our flight plan and continue.

An experimental airway was used to test the system about one year ago. As we approach the second station, the bearing needle starts to rotate, or search, but the distance continues to read correctly and as we fly over the station, the distance never gets less than 5.2 miles, and then it starts to increase. The bearing continues to search until we are well past the station and then it locks on again.

Why do these things happen? The distance never reads zero miles from the station because we were never zero miles from it. When we were directly over the station at 30,000 feet, we were 5.2 miles away, in a vertical direction. This point must always be kept in mind when flying near a ground station: TACAN measures the slant range between the aircraft and the ground station and not the horizontal distance. At first thought, this might seem like a serious deficiency in the system, but a second look tells us that all radars read slant range and for good traffic control, both of the systems must measure distance in the same terms.

While passing the station, we noted that the bearing indicator searched for an unusually long time. The cause of this phenomenon is another characteristic of the system. The cone of confusion (cone of silence) is 120 degrees in width. This is twice the size of the confusion zones on most earlier systems. At 30,000 feet, you will be in this area for a distance of about 18 miles, and at 50,000 for a proportionately greater distance. To compensate for this feature, Air Traffic Control's reporting and letdown procedures will probably be changed. Rather than reporting over a station, pilots will probably report at a given distance and on a given radial from the station.

Continuing our imaginary flight, we climb to 51,000 feet and note that the set stops working. This happens because a barometric switch automatically turns the equipment off whenever it is above 50,000 feet. Later models will be pressurized which will eliminate this situation.

It is not necessary to pass over the station at destination to get a positive fix, so we can start a straight-in letdown from any point and thereby save time and fuel. (Letdown procedures have not been definitely established; however, they'll be published as soon as the necessary coordination with CAA and other agencies has been completed.) Now, let's land and continue this discussion.

There are a couple of remote possibilities which might cause abnormal operation of TACAN. The odds are about 10,000 to one that they'll ever happen, but the more we know about a system, the more use we can get out of it. The basic principles of the system make possible a bearing error of 40 degrees or any multiple of 40 degrees. If you ever see an error of this magintude, it will be near the maximum range of the ground station or near the cone of confusion. Ordinarily these errors last for less than one minute. They will correct themselves—except in that 10,000th time and then you will recognize the situation because the error will be so large.

The other possibility is that the set may try to lock on to two stations at the same time. This again is a remote possibility because stations operating on the same channel will be located as far from one another as possible. In congested areas, however, it may become necessary to locate two stations on the same frequency within 400 miles of each other. At high altitudes, halfway between the two stations, the TACAN will become confused. Don't let this shake you, just hold your heading for a few minutes and it will point to the station that is nearest.

Much of this may seem like fault-finding. I've flown the system throughout its development, and believe me, it's the most. The only reason for explaining some of its oddities is to make all flights safe, through the understanding of equipment.

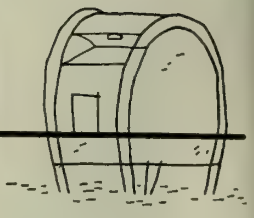
The last question read, *When will we have it to use?*

Some ground stations are being installed today and the system is expected to be ready in the ZI by 1959. Overseas installations will be phased in, some before and some after that date. New aircraft will receive the equipment on the production line and older aircraft will be retrofitted as soon as practicable.

In summary, TACAN is the new short range, omni-bearing, distance measuring navigation system which will be available for military and civilian use in 1959. ▲

CROSS FEED

LETTERS TO THE EDITOR



Bouquets and Brickbats

Many thanks for Lt. Col. Mulholland's articles. Not only was each article individually the greatest, but the combination of all was the best presentation of subject matter I have seen in FLYING SAFETY to date. And you've sure had some fine ones through the years! Although an officer of Colonel Mulholland's qualification, experience, and professional ability must be in great demand, let's hear from him again on occasions for the benefit of the system and all concerned. Many of the flying safety anecdotes that I have discussed in Instrument School presentations for pilots of ADC Headquarters have been gleaned from your publication. Col. Mulholland's articles are at the top of my recommended reading list.

Now for a brickbat instead of a bouquet. In reference to the November issue, "Chart Chatter," page 27, second from the last paragraph: "—snip off a small triangular square—." This is readable writing? I just cut off the corner in the shape of a triangle and it works good. I'm still trying to find a triangular square. Maybe it's me.

One more comment from this writer. A recent article in Air Force Times concerned a lost T-33 due to complete inverter failure. This boy apparently didn't know because nobody told him all the answers on VOR equipment.

With both inverters "out," the Course Deviation Indicator in relation to the course selected and the ambiquity (To-From) window still are operational. No need for great panic here. Major W. E. Preble of ADC recently, ably returned to Colorado Springs from out of the West, under similar conditions. Using the VOR equipment he had left in connection with stand-by compass and ILAS, the flight was methodically completed with no radar in the area.

Know the aircraft and equipment, and fly it accordingly. Knowing what you have left and how to get the most from it may save an aircraft. The lad in Air Force Times lucked out through aid from GCI. I don't mean, however, to take any praise from GCI for a job well done.

Capt. George E. Kammerer
Asst Base Ops Officer
Peterson Field, Colorado

Thank you for your gracious comments on Col. Mulholland's articles and FLYING SAFETY, in general.

Our apologies for having you attempt to cut a square circle, correction—triangular square. And, lastly, thanks for your comments on the OMNI. There is no substitute for knowing your equipment.

★ ★ ★

Rain Repellent

Several months ago, FLYING SAFETY published an article entitled "The Forward Look." It discussed in detail the merits of a rain repellent for use on windshields and canopies of aircraft. The article, however, did not include information as to the procurement of such a rain repellent.

We fly the B-50 and this, in itself, should explain why we are interested in any product or theory that might improve the forward visibility from the pilots' positions. The plexiglass nose of this aircraft, even when dry, presents some serious handicaps to visibility. When that same "nose" is covered by any precipitation, visibility is dangerously affected.

The most desirable solution, from a pilot's point of view, would be for the whole nose section to be modified to permit proper visibility forward without all the obstructions caused by the reinforcing frames around the many "little windows." We realize that it is very unlikely that the Air Force would undertake such a project on an outmoded aircraft, but it certainly would be a great step towards flying safety in the B-50.

Now, back to the original subject of this letter. We request that we be provided with the name, stock number and specifications for the rain repellent discussed in your article. We'd like to requisition some of this rain repellent. Also, we would appreciate it greatly if you could arrange to have a sample quantity sent to us as soon as possible. Operating under the type of weather typical of the Rhein Main area, we can certainly use anything at all that will aid in the improvement of visibility from this aircraft. I am sure you realize that the flying weather in this area is comparable to the worst in the United States (i.e., Pittsburgh area).

We'd like to suggest, if possible, you make it a practice to include the name, specifications and stock numbers for new products reviewed or cited in your magazine. We'll be very much interested in your reply to this letter and will appreciate any information you may forward to us.

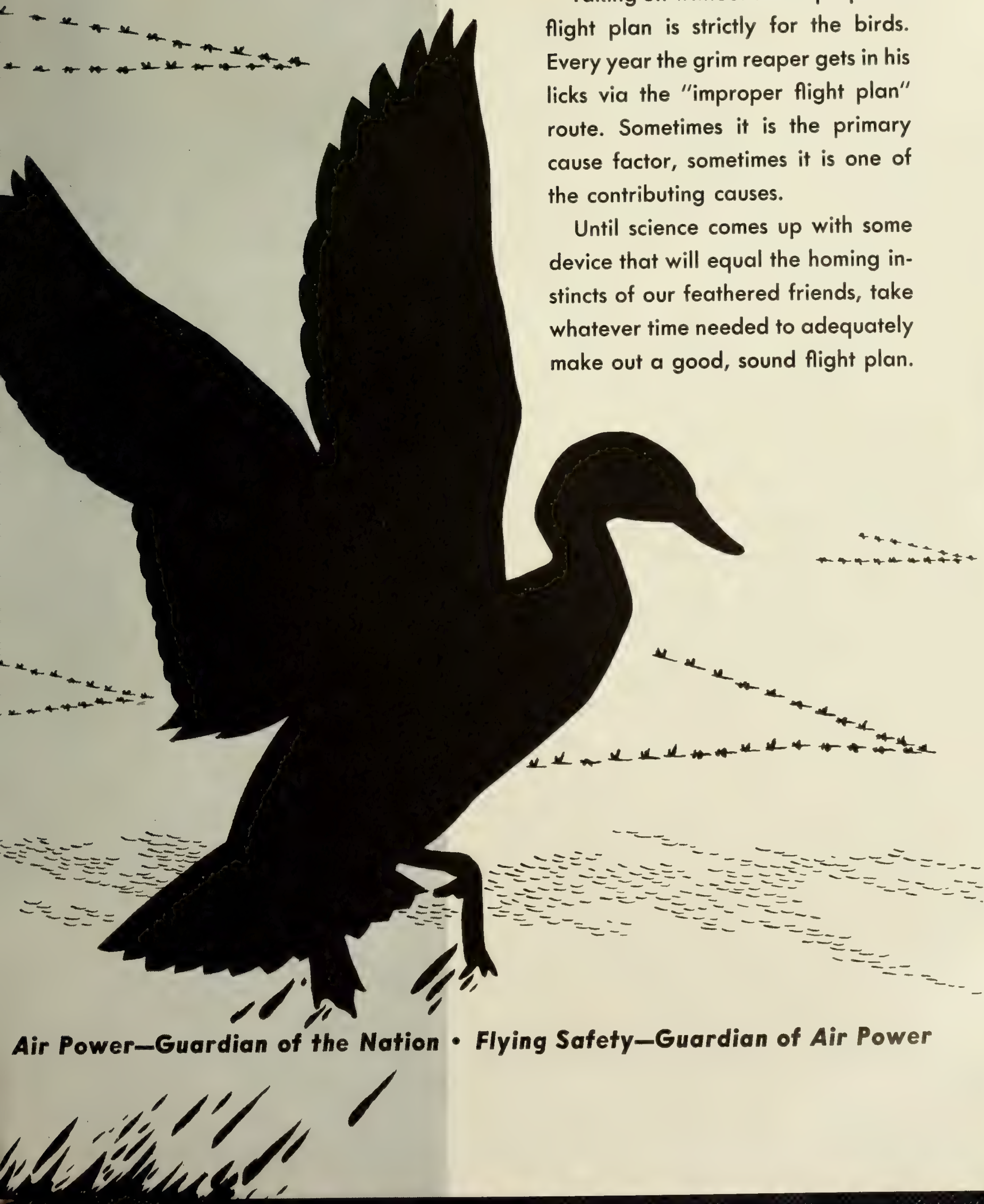
Captain Edwin R. Gardner, Jr
7406th Support Sq USAFE

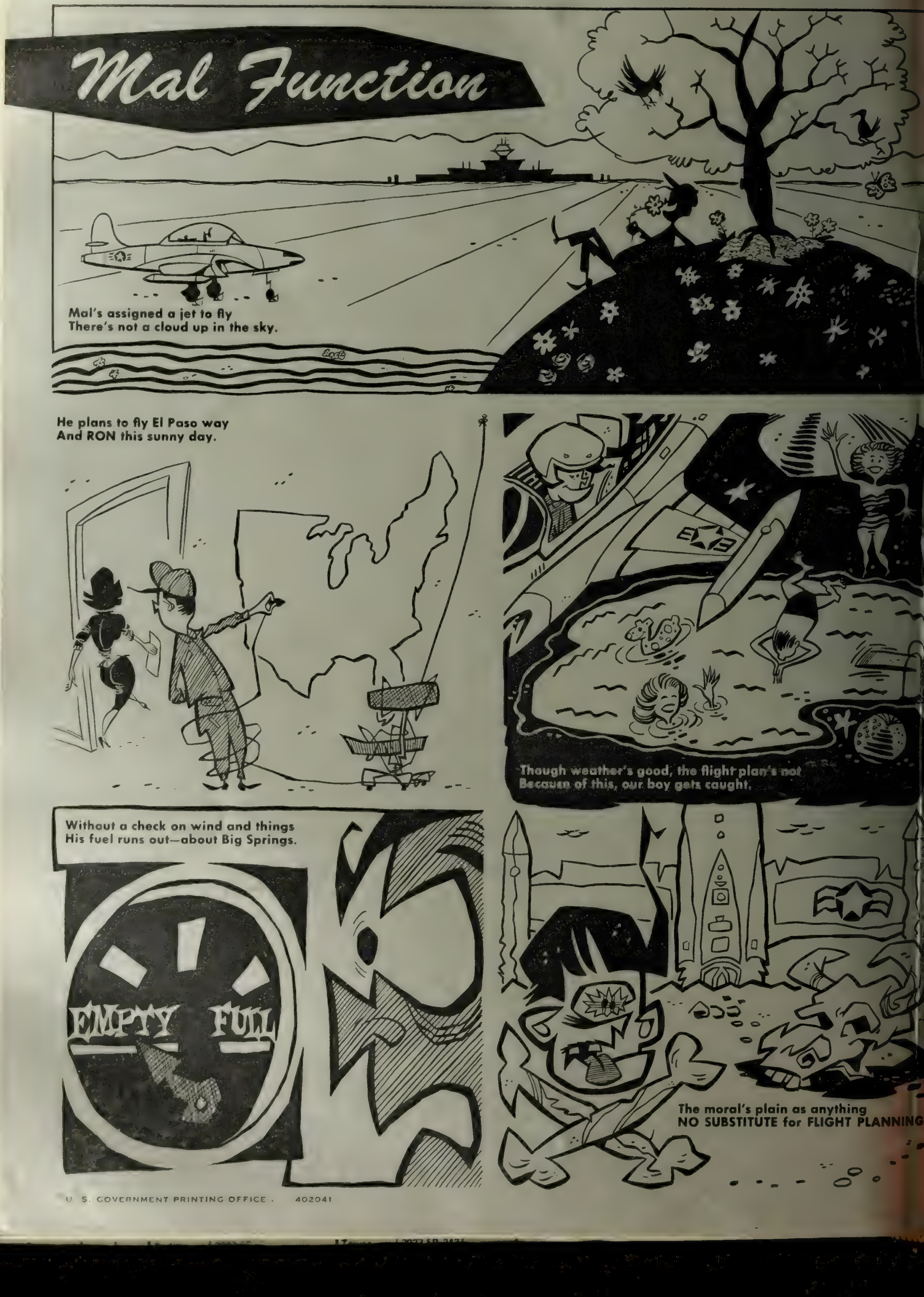
Rain Repellent Kits come in two forms. Kit Type One is made by Foster D. Snell, Inc., under Stock No. 29110-17288. Type Two is put out by the Canadian Research Council, AF Stock No. 6850-341-8430. T.O. 42D4-1-4 may be used as authority for requisitioning kits, via channels, through the Topeka Depot.

.....for the birds!

Taking off without a well prepared flight plan is strictly for the birds. Every year the grim reaper gets in his licks via the "improper flight plan" route. Sometimes it is the primary cause factor, sometimes it is one of the contributing causes.

Until science comes up with some device that will equal the homing instincts of our feathered friends, take whatever time needed to adequately make out a good, sound flight plan.




Mal Function
Mal's assigned a jet to fly
There's not a cloud up in the sky.
He plans to fly El Paso way
And RON this sunny day.
Though weather's good, the flight plan's not
Becauen of this, our boy gets caught.
Without a check on wind and things
His fuel runs out—about Big Springs.
EMPTY
FULL
The moral's plain as anything
NO SUBSTITUTE for FLIGHT PLANNING

U. S. GOVERNMENT PRINTING OFFICE . 402041

FLYING SAFETY

UNITED STATES AIR FORCE

MAY 1957

the emergency..

THE LIBRARY OF THE
MAY 21 1957
UNIVERSITY OF ILLINOIS

File Thirteen

May is the month for FLYING SAFETY to feature "The Emergency." Your attention is invited to page one and to the accident briefs on pages two and three. . . . A recent FTAF brief carries an interesting item as follows: A student placed his helmet on the wing of his aircraft while putting his chute in the cockpit. The mask picked up some JP-4 residue that was on the wing. This, combined with oxygen during the ensuing flight, resulted in first and second degree burns on one side of the pilot's face. . . . There have been several incident reports lately which indicate that pilots are not aware of the altitudes required to be maintained, when flying VFR or one on top. For those of you who are in doubt, get with the PIF and read Par 32d, AFR 60-16. . . . Next month's subject will be the "Crew Station." Among other important items will be a word or two regarding external removal of canopies during an emergency. There have been cases where the first people to arrive at the crash scene were unable to free the pilot because they didn't know how to open the canopy from outside the cockpit. You will get the word on what is being done to help eliminate this possibility.

'til June,

Perry J. Dahl

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Please send Flying Safety Magazine for one year to the following address. Enclosed is a check or Money Order for $2.50. ($3.50 for foreign mailing.) Catalog No. D-301.44.

Name________________________________

Address______________________________

City____________________State____________

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major Vernon R. Stutts

Associate Editor
Major James W. Bradford

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby

Editorial Asst.
Amelia Askew

Distribution
T/Sgt. William H. Johnson

CONTENTS

Mayday 1
In God We Trust 4
On the Short End 8
Panic 11
Eye in the Sky 12
Just a Trigger Man 17
What's the Pitch? 22
Rex Says 24
Flying the C-45H 26
Crossfeed 27

VOLUME THIRTEEN NUMBER FIVE

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all corrspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in order to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

MAYDAY means trouble—big trouble. And May is the month during which we're set to take a searching look at the MAYDAYS that seemingly stalk the trade, at the problems behind MAYDAY and a good, long look at "The Emergency" which always precedes the pilot's call for help.

What makes for MAYDAY? Let's start with the set of circumstances that every Air Force flight begins with, namely, the qualified man or men in the readied aircraft cleared for the takeoff roll. What factors make for the emergency that may or may not lead the pilot to call MAYDAY? Is luck a factor? Or is there in every emergency situation a certain something which can be done before the MAYDAY comes around? Luck is for gamblers, not for you. It may be there but the man who depends on luck in this business never wins. The laws of failure are not the laws of chance. MAYDAY means that something or someone has failed. It starts with you.

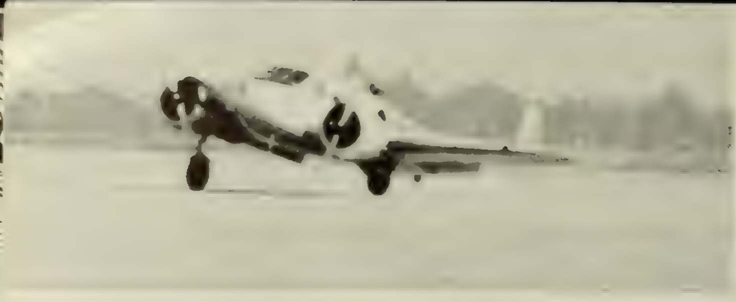
You are given an airplane to fly. You've got to know this airplane inside and out. There shouldn't be a single rumble in your bird that doesn't give you a message. You've got to learn its language, the sounds and signs with which it warns the knowing listener that something is wrong. More than that, somewhere within the four million brain cells with which you think and learn (and remember what you have learned), you should have catalogued and ready for instant use, all of the factors involved in the flight of your particular aircraft. No matter how hard pressed you are for time, this is important.

MAYDAY!

This means you should foresee any emergency that might arise and have in mind a plan of action to take. Speed alone—the speed with which things can go wrong—establishes this necessity. When the red light goes on there isn't much time for you to meditate. All the choices available to you in that time of emergency should be obvious immediately. You should know exactly what you can and can not do.

Too many men have wondered when they should have known. The history of pilot and aircrew reaction to an emergency situation, too often tells the story of a failure to hear the aircraft's warning voice, a failure to see that trouble is imminent and a failure to know just what to do when the warning light comes on suddenly.

That's why we've declared this to be the month to feature MAYDAYS, to let you know that luck is no substitute for knowledge, that trouble begins right where it ends—with you—and that, in flight, a poorly educated guess is worse than ignorance. You might just guess you can do something that can't be done and that, my friends, is not professional. And a professional pilot is what you've got to be! You've got to know yourself and you've got to know your airplane. There isn't any other way to keep from yelling MAYDAY loud and clear when you don't know why in the world this one gray day had to dawn.



Mayday • Mayday

A FLIGHT OF three F-86Fs departed on a cross-country and it was an uneventful flight until they reached their destination. At that time the leader experienced UHF transmitter failure and visually instructed a wingman to take over.

The flight entered initial and the pattern and approach appeared to be normal. Two of the aircraft landed but the pilot who had radio transmitter malfunction, initiated a go-around. He advised the tower by rocking his wings that he was remaining in closed traffic. On downwind he was cleared by the tower to land and he acknowledged by again rocking his wings. After rolling out on final, however, he was advised that his gear appeared down but the gear doors were still open. He continued on course roughly parallel to the runway, toward the control tower. His airspeed was very slow and apparently he was attempting to get a gear check by the tower. Just before passing it, his aircraft started a diving left turn. He recovered partially but his airspeed was obviously too slow and he contacted the ground in a wings-level attitude. The '86 began breaking up on ground contact and was totally destroyed. The Air Force lost another pilot.

Comments: Investigation revealed that this pilot had an unsafe gear indication but there were no power difficulties. This is an example of how an inflight emergency distracted the pilot to such an extent that his aircraft was stalled into the ground.

■ ■ ■

THIS ACCIDENT happened during the landing phase of flight when the pilot of a T-Bird overshot the runway and intentionally retracted the landing gear. The pilot took off on an IFR flight, 1000 on top. Upon leveling off at 25,000 feet, the fire warning light came on, went off, then came on again. The pilot reduced power and the light went out. A few seconds later, fuel fumes were detected in the cockpit. The pilot declared an emergency and returned to the field. Weather was 2000 feet and two miles in haze and smoke. The pilot sighted the runway from 5000 feet over the range station and attempted a traffic pattern to the downwind runway. He was too high and too fast but elected to crash land at 200 knots IAS. The aircraft was damaged. Neither pilot was injured.

The final evaluation of this accident was supervisory error in that the IP did not follow the Dash One procedures to determine if a fire did exist. An additional cause factor was poor technique in the traffic pattern.

Essentially, the evaluation read like this: The presence of fuel fumes in the cockpit plus an indicating fire warning light would indicate a dangerous situation. However, the statements of both pilots indicate that raw fuel fumes were detected several seconds after the fire warning light illuminated and immediately after the throttle was retarded. It is not unusual to detect fuel fumes momentarily in the T-33 aircraft, following power reduction. It is significant that neither pilot reported the presence of fuel fumes during the remainder of the flight.

A prolonged fire presents the danger of destroying control push rods but the danger of explosion is at the time of primary ignition. The fact that the pilot continued to operate the aircraft engine indicates that he did not believe that an explosion was imminent and that there was some doubt that a fire did exist. After several minutes of operating at reduced power setting, the pilot would have had definite indications if a fire actually existed.

The procedures outlined in T. O. 1T-33A-1 regarding fire warning and overheat lights are considered adequate. The caution, "The lights may come on because of a short circuit," as well as the step procedure to determine if a fire exists are the result of the aircraft operational history.

If a fire does exist, the procedure is:

- Throttle off.
- Main fuel shut-off switch closed.
- Elect to bail out or crash land.

After declaring an emergency, the pilot accomplished a letdown and arrived over the range station at an altitude of 5000 feet. From this point, he had the runway in sight. A straight-in approach permitting a GCA would have been expeditious and would have been directly into the wind which was recorded at 10 knots with gusts up to 21 knots. Electing to establish a traffic pattern and land downwind indicates questionable judgment by the IP and the pilot. Improper technique was employed by the pilot throughout the traffic pattern in that excessive airspeed was maintained as the aircraft approached the runway. Under the existing conditions a deliberate crash landing was considerably more hazardous than a go-around or a close-in procedure to the active runway.

WHILE TWO F-89s, on a scramble mission, were passing through 20,000 feet, the leader heard a strange thrashing noise in his aircraft. He called to his wingman and asked him to fly under his aircraft to see if something might be hanging from it. Number Two closed on the lead aircraft at an excessive rate and flew under the leader and the tail of his aircraft struck the right wing of Number One. The lead aircraft went into an uncontrollable spin. The pilot finally ejected but the radar observer was unable to remove his safety pin and was killed in the crash. Number Two aircraft pitched up violently after the collision and became uncontrollable; both the pilot and observer ejected successfully.

Comments: Another case where an inflight difficulty plus pilot carelessness resulted in a major accident. The leader was so intent on identifying an unfamiliar sound that he neglected to see the rapidly closing wingman. The wingman was so absorbed in signs of damage to the lead plane that he failed to provide adequate separation.

■ ■ ■

AN F-84F PILOT experienced partial loss of power while flying at 34,000 feet on top of a broken to solid overcast. Switching from normal to the emergency fuel system failed to remedy the situation. He let down through a hole in the overcast and recognized his position to be 14 miles northeast of his home base. At an altitude of 2000 feet, 70 per cent RPM was maximum available. In this situation, the pilot had to make a quick decision. At this time the pilot's wingman advised him to pull up and bail out. The F-84 was observed to pull up, but the pilot made no effort to eject. The pilot then transmitted that he would attempt an emergency landing on a small abandoned Army airfield. Lining up with an access road to the airfield, he lowered flaps and continued his approach with the gear retracted. The '84 struck trees several hundred feet short of the airfield, exploded and disintegrated. The pilot was fatally injured.

Comments: The accident investigating board determined that a clogged, low-pressure fuel filter caused the loss of RPM. The pilot, with only 19 hours 30 minutes in the F-84F, chose to descend through an overcast and attempt an emergency landing on an extremely short strip rather than eject. There are times when the ejection seat is the wisest and safest way out of a bad situation. This is one of those times when the trigger should have been squeezed.

It was one of those weekend trips when nothing goes right. The pilot was on his way to Boontown, near Philadelphia, in a T-33. He made a refueling stop at Alpha Air Force Base without official orders. A discrepancy was filed against him. "This," he said in his incident report, "was the beginning of my bad luck." From here on the ride was rough.

Published four years ago in FLYING SAFETY, this pilot's report is reprinted now because it underlines the deadly fact that a series of little errors can lead to a big emergency. The lessons you can learn from this account still apply.

Remember, this happened as it is told. Only the names were changed to protect the human factor, a handful of men whose tendency to err almost resulted in a fatal accident.

In God We

BEFORE TAKING off from Alpha, I checked all the NOTAMS and even the Airman's Guide for anything on Boontown. Everything looked okay, so I took off. When I arrived over Boontown, however, the tower told me the people who were supposed to meet me there were at Oakville. "Great," I said, "but my clearance says land at Boontown."

"Well, you can land here if you wish," the tower came back, "but we only have 3100 feet of runway because of a construction job going on." I told them the NOTAMS didn't say anything about that. "It's true, anyway," they said, so I changed my flight plan to land at Oakville.

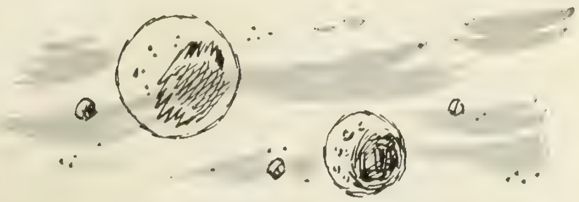
There I came over the airport, called on initial, called on the pitch and then base leg. As I turned onto final, the runway ahead looked six inches long. I called to ask how long it actually was and they said 4000 feet. The shortest runway I'd ever landed on was 5000 feet.

That wasn't all. I had about 360 gallons of fuel aboard. At this end of the runway was a fence, a road and some large colonial type houses with tall, peaked roofs. I don't think they'll need any coal this winter. I warmed them up pretty well with my tailpipe coming in. Somehow I pitched at the right spot and turned on base and final at the right places, a perfect approach for landing. I landed just down from this end of the runway with plenty of room to stop.

Now, since the longest runway at Oakville is only 4000 feet, I told them not to put more than 60 gallons of fuel in each tiptank. I'd go on to Lima AFB and get refueled there in the morning.

"Roger," they said. But after making out my clearance the next morning, I walked on out to the aircraft and found that they'd put the full 230 gallons in each tip. The runway looked even shorter than it had the day before. In addition to the obstructions at one end, there was a hill at the other, and what had been

Here is an article that a pilot took time to write after a rather hair-raising experience. There are many lessons to be learned here, not the least of which is "Share your near-miss tales."



Trust . . .

The T-33 is a real, good bird, but when you goof around like I did, watch out!

three tall, sturdy oak trees. Now there were only two. Someone had chopped the middle one down. But there were high tension wires to fill this gap.

I cranked up and taxied out, sitting there for a while at 92 per cent, burning out some of my fuel. There was practically no wind, but fortunately, it was fairly cool.

The Takeoff

Finally, I said to myself, "Well, I think I can make it." I pulled my flaps up, moved onto the runway and ran 'er up to 100 per cent with the brakes on. Releasing the brakes and starting the takeoff roll, I discovered something else. Not only was the runway just 4000 feet, and cut off by the trees it was also *uphill.*

As the airspeed came up to around 100 mph, I put the flaps down to 30 degrees, brought the nosewheel up and finally staggered off between the two remaining oak trees, clearing the high tension wires only by inches. I was on my way.

Misreading my radio compass, however, I missed Lima AFB by 20 miles or more. Even then, when I finally found the field, I landed ahead of my ETA—with winds almost 180 degrees opposite those on which I'd been briefed.

It was now Sunday afternoon and, although I hadn't planned it this way, I'd have to do some night flying to get back in time. It was then that I remembered I had no flashlight. I tried to find one at Lima but everything was closed. Base ops had none. Personal Equipment had none. So—at last I told myself, "Well, I won't need one anyway." I filled out my clearance and went to the airplane.

There I sat in the cockpit waiting for ARTC clearance with an APU plugged in, standing by on the radio. When the clearance came, I copied it down, repeated it back to the tower and signaled to the crew chief to watch for the start. It was a good one. I looked back to signal the crew chief to pull the APU. Reached over to throw the battery switch on — and then out of the corner of my eye I happened to catch a glimpse of a red flag. The canopy pins hadn't been pulled. I called the crew chief. And this is where I really slipped up.

I took my hand away from the battery switch. It was off. (After the pins had been pulled, I just forgot the switch.)

It was still off as I climbed out on course and broke into the overcast at about 6000 feet. It was off and forgotten as I continued climbing on up to 35,000, my assigned altitude. There were none of the layers that the weather office had predicted. It was a solid overcast all the way up and not a bit lighter at 35,000 feet. This didn't make things any easier.

As all of you know who've tried to tune in a station on the ARN-6 radio compass in the T-33, when you are in visible moisture or precipitation, in clouds or in the vicinity of a thunderstorm, the static is so complete on the set that you can't identify the station. All you can do is crank the handle close to the kcs and hope you've got the station you want. That's what I hoped. I did some guessing too. I knew I had an effective headwind of approximately 80 mph so I continued on course until by dead reckoning I should have been pretty close to Leetown, North Carolina.

In the meantime I'd made another mistake. I hadn't been briefed on ice, I was supposed to be clear of all clouds, no visible moisture—but as it turned out I had taken off IFR into possible icing conditions. The airplane started to get sluggish. Looking out at the tiptanks I saw about seven inches of ice cones sticking out on the leading edges of the tanks. Then I remembered that I hadn't turned the pitot heat on. I reached down to turn on the right console lights so I could see the pitot heat switch.

Then I looked back up at the flight indicator, straightened out my wings and reached down again to locate the switch. I felt it, took a quick glance down (flying in bumpy weather with my left hand), straightened the wings again, took another quick check of that switch just to make sure I had the right one, and pressed it.

Not knowing it, I hit the emergency fuel checkout switch instead and the sudden surge of fuel drowned out my flame.

Never in my life have I felt so lonely. It was quiet, real quiet—the derndest quiet I've ever heard. There I was at 35,000 feet on solid instruments with my first flameout in an aircraft with which I wasn't too familiar (I had only 150 hours in the T-33). And I began to panic.

I was just about ready to begin an airstart when it suddenly occurred to me that an airstart shouldn't be tried above 25,000 feet. I had 10,000 feet to lose. I decided to lose it quick, make an airstart and come back up again. I lowered the dive flaps and lowered the nose to pick up that 25,000-foot level as fast as I could, paying strict attention to the RPM. At 25,000 feet I drained the tailpipe, the hardest thing in the world to do when you're on instruments.

Then I hit the airstart switch. The RPM had dropped to 20 per cent. The lights dimmed, the radio went out and I had no more electricity. I knew that as soon as the electrical power failed I'd be flying by the airspeed, period. But the needle and ball are the last of the gyro instruments to go out. I went immediately to airspeed needle and ball and RPM, trying to keep the RPM up to the desired 10 per cent. It wasn't easy to see the instruments, however. I certainly missed my flashlights then. I loosened my shoulderstraps to lean forward over the stick. I must have been three inches from the panel. Even at that I wouldn't have seen very much if it hadn't been for constant flashes of lightning. Every now and then a sheet of lightning would come just in time to help me get out of a tight spiral. My windshield was a solid sheet of "St. Elmo's" fire.

Well, I pulled up the dive flaps so I could get the desired RPM and the airspeed necessary to hold it without losing too much altitude. And I made seven panic airstart attempts! Nothing happened. It wouldn't start.

In the vicinity of Leetown, the highest mountain is somewhere around six to nine-hundred feet. I knew that long before I got that low I'd have to get out of this thing, if it didn't start. As I passed through 10,000 feet, I tried another airstart, going this time directly by the checklist to make sure I didn't forget anything. Still nothing happened. I hit the panic button again and started to get out, moving baggage, maps, everything else away so I could pull the yellow handle on the right hand side and blow off the canopy. I had already practiced putting my feet in the stirrups and lowered the seat as far as it would go. I was ready to leave. And all I could think of for a moment was my wife, waiting for me at base ops. She was sure going to be mad about this. I was standing her up.

After I got a start, I looked back to see if the APU was pulled. I never did turn the battery on.

I managed to control myself a few moments more and tried to think of the reasons why I wasn't getting an airstart. There were two of them, I decided. Number one: It wasn't getting fuel. I discounted this because I knew the fuselage tank had fuel. Number two: It wan't getting any spark. Probably my battery had gone dead on the first airstart—could have been old, wornout. Then I thought, "Maybe the battery switch is off. No," I said, "the battery switch is ON. I remember turning it on at Lima. Well—" I told myself then, "don't be so dern stupid. Check it!" I reached over then and found that the switch was OFF.

Close to God

I turned it on. The radio came back on, the lights went on, and the instruments began to bobble around. Right then I felt like I was pretty close to God again. On the next airstart, she fired right up—just as though nothing had ever happened, just as though that's the way it was written in the book.

I was around 8000 feet so I rode on down to 6000 and got enough RPM and airspeed to get my throttle around the horn. My radio was operating now so I immediately started calling in the clear for any D/F station that read me, to give me a call on guard channel. Sierra AFB answered and said they were reading me loud and clear. I told them to please notify all appropriate agencies that I had flamed out and had come all the way down through Green 5 from 35,000 to 6000 feet, with no radio contact. Also, I told them that I was going to climb back up to at least 25,000 feet to an altitude consistent with good fuel usage.

They answered, "Stand by." Then, added, "ARTC advises that you remain at 6000 VFR. They have heavy traffic in that area."

I called Sierra and said, "You can tell ARTC that I'm lost. I don't know exactly how much fuel I have left and I'm going up to 25,000 feet or higher to an altitude consistent with good fuel usage."

They answered, "Roger. Stand by."

So I stood by a little longer and they came back with, "ARTC insists that you remain at 6000 VFR."

I called back that I could not remain there and that I was going up to 25,000 feet. "I've declared an emergency and if they have other traffic in the area, have them get it cleared out."

They said, "Roger. Stand by."

And, finally, they came back with "ARTC clears you to 25,000 feet."

As I climbed up through 14,000 feet I gave Sierra my first tone for a steer. My heading to Sierra was about 201 degrees.

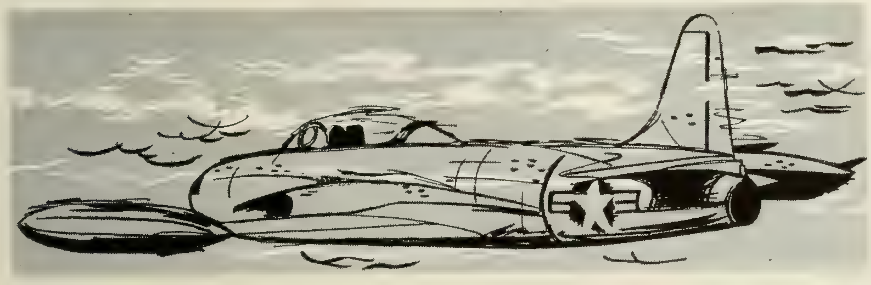
I had been pretty proud of my instrument flying prior to the flameout. I had been holding my heading within three to four degrees either side and my altitude to within 100 to 200 feet in bumpy weather at 35,000. I was really proud of it. But, after the flameout and after I had climbed to 25,000 feet, Sierra would occasionally ask for my present altitude. I would say, "27,000 feet." They would call me about five minutes later and I'd say, "22,000 feet." I couldn't hold my altitude within 5000 feet.

I called Sierra and asked what the weather was down there. They answered that they were okay and for me to come on down. I called them once more and requested their weather. Again they answered, "We're okay. We can get you in fine. Come on down." I called a third time and they answered. "There's no sweat." So I called again and said, "I *demand* the weather." Sierra answered, "We have a 700-foot overcast with 100 scattered, visibility one mile, with rain and fog." I immediately started a one-eighty and told them that I was sorry but I wasn't going down there, and began calling for any other D/F homer that could read me.

Samtown, South Carolina, tower called me and said Apple Valley D/F homer was reading me, but that they had a weak transmitter and I could not read them. There was a long distance telephone line open between Apple Valley and Leetown for this emergency, however, and they'd be glad to relay any steers from Apple Valley to me. Apple Valley's weather was 3000 feet overcast. I transmitted for one minute for a steer. They came back with a heading of 110 degrees. I called Sierra and told them I was going to Apple Valley and to stand by for any D/F steers.

Echo Radio called and said, "We understand that you're having a little difficulty. Can we help you?"

"Roger," I said. "I have a heading of 201 degrees to Sierra and 110 to Apple Valley. Get out your maps and rulers and tell me where I am and how far it is to Apple Valley."



It was solid overcast all the way up and not a bit lighter at 35,000 feet.

They called back in two or three minutes to say that I was about 175 miles from Apple Valley.

I looked at my fuel gages. I had plenty—enough to mess around a bit and that was fortunate. I kept getting steers from Apple Valley and some from Sierra, then I'd transmit them to Echo and they'd spot me again.

But I was back in the soup at 25,000 feet and couldn't tune that radio compass. Here's another error. I had no map of the Apple Valley area. I had a Radio Facility Chart but I couldn't get it out of the map case. It was lodged between the East and West Handbooks and the Jet Letdown Book. I even tore the cover off the West Handbook trying to get it out. I had no way in the world of knowing the frequency of the range station at Apple Valley so I called and asked them to give it to me. I had to ask four times before they were convinced that I was in trouble. I tuned as close to the kcs as I could get. I flicked over to the compass position. I noted that the tune for the max needle was deflecting when the station identification letters were sounding. I heard an "M" and a jumble of static, then a "P" so I figured I had the right station tuned in.

Echo Radio had me in pretty close to Apple Valley. The compass needle was reading about four or five degrees off my nose. When the needle swung to the full rear position, I called the tower and told them where I was and asked for the heading of the range leg where I was to make my letdown. They said to make a standard jet penetration. After calling them two or three times I finally got out of them that they wanted me to let down on the southeast leg on a heading of 140 degrees.

I turned back in 180 degrees to the range station and hit it, tracked out for a minute or a minute and a half, and made a high-speed letdown at 325 mph, made my jet penetration turn and started back in.

At an altitude of 3000 feet, I figured to break out under the overcast. At 3000, however, I was still in the soup so I called for anybody who could read me and asked them to give me a call.

Finally, Lima tower answered that they could read me, but weak. I was reading them fine and said so, and asked for the minimum altitude and weather. They answered, "3000 overcast, with five miles visibility." I kept on at a 320-degrees heading and broke out about 1100 feet over the ground and called back to ask the heading from the station to the field.

If I hadn't been in a sweat when they told me, it wouldn't have been a puzzle, but when they said the heading from the range station to the field was 140 degrees, I was lost—really lost. I nearly gave up again, right there. I was now heading 320 degrees and I couldn't figure out why they wanted me to turn. I was just about to hit the panic button again when it occurred to me that the field was between me and the station.

I drove on in just under the ragged edge of the overcast until finally I saw the blinking light, the double white with the green on the back, flashing from the beacon at Apple Valley. I called, then switched over to tower frequency and said that I had the field in sight. Believe me, it never looked so good.

At Last

Down on the ground again, I sat there for 15 minutes before I could even get out of the cockpit. I had made all the errors I cared to make.

Back there when I had reached down for the pitot heat switch I had, of course, hit the checkout switch instead. I couldn't make an airstart at first because my battery switch was off. A flashlight might have helped me, too. I've always carried a flashlight prior to this trip. (I've been carrying one since 1942.) This is the only time I ever forgot to turn on the battery switch and it is the first time I ever had a flameout. It's the first time I ever hit the checkout switch while in flight and it's the first time I ever hit it without being prepared for such a thing.

It is not the first time I have made a flight without maps of the complete area, but it is one of those things—you never expect to make better than a 180 and come back to an area that you don't ordinarily hit. All the same, it was a mistake. I should at least have had a jet handbook.

And as soon as I discovered my flameout, I should have called ARTC immediately to let them know that I was in an emergency. But it was one of those times when pride jumped in and said, "To heck with it. Don't let anyone know you've had a flameout, especially since you did it yourself. You can get back up before you reach 20,000 feet—no sweat."

As you can see, each of these little details in themselves would not have placed me in serious trouble. It was the accumulation of all these errors during one flight that nearly ended my Air Force career. ▲

Here's hoping you never have to get a flamed-out jet into an airfield. But if you ever do, here are a few tips that may stand you in good stead.

...on the short

THE MAGIC word came over the UHF monitor in Operations—"Flameout!" And the effect was electrifying.

The pilots cast inquiring glances at each other: Who is it? What is his position?

Then came the answer: "Green Flight, go to emergency channel and keep quiet."

The boys in Ops pressed closer. Captain Dief, the Ops Officer, switched to guard channel.

"Mayday here — Mayday! Clark Tower, this is Green Lead. I'm flamed out. I'm coming in to the south—right now—so clear the field. Green three. are you with me?"

"Five square," came the answer. "Roge, you handle the conversation from here in."

This told the pilots in Ops all they needed to know. They started for the ramp in a dead run, the incessant ringing of the crash phone giving length to their strides.

Green flight had just taken off and Sam Croner was leading. There were only three T-Birds in the flight so Captain Croner had briefed for a V-formation. They had taken off to the north. Sam held it down to pick up climb speed, then rolled in to his first turn just before reaching the town of Mabalacat.

As he rolled level, Brink slid underneath, already reversing his bank to close on the outside wing. In no time at all, Lieutenant Brinkman socked it in. A glance to the right showed that Lieutenant Baker was closing nicely.

He pounded his hand against his helmet and wondered, "What's wrong with my thinking?"

The leader held steady to allow No. 3 to position before the turn away from him. Then, as Captain Croner was looking his wingman right in the eyes, it happened! Poof! No steam! Nothing sensational, just the stark and sudden realization that there was no fire in the pot. His first concern was over the ability of the wingmen to clear him. This was solved as swiftly as the thought. They were in close, but properly. The prescribed stack-down had given them enough room to slide right by. As soon as the wings were clear, Captain Croner pitched into a chandelle toward the field. "I'm fat for bailout," he thought, "but maybe I can take it home." As soon as the runway came into sight, he knew he had it made. That's when he called the tower.

Things didn't go well for Sam Croner that day. In retrospect, they hadn't for several days. He was in his second day of the silent treatment at home, and now his second love was giving him some of the same.

He found himself on a wide base leg, with plenty of altitude. Level off, set up at published glide speed and try for an airstart, he mused. Got over 10 per cent rpm — that's good. Now—all tanks on—hit the igniter and hold it a moment. Okay. Now put

Capt. Harry J. Tyndale
666th AC&W Sq.
Mill Valley AF Sta. Calif.

end...!

He still had plenty of airspeed and altitude, landing was assured.

the fuel to it! A look around to the outside, then a call from Dale Baker: "Get rid of the tips!" Oh yes, we mustn't forget the little things. Sam dropped a wing for a schoolyard check and since there was none within miles, he reached up and depressed the shielded red button. As he did so, he popped the stick to take the weight off the shackles.

His calm glance at the tips revealed nothing. Nothing? This is a hot circuit, wired directly to the battery. It *can't* malfunction!

Three more tries just proved that things are not always what they seem. The airstart had been equally unsuccessful. He still had the right airspeed though and plenty of altitude. The landing was assured. Sam was shook, though. The tips should have gone. He ran the back of his fist down the circuit breaker row and tried again. No good. He ran through another airstart. He tried to find the armament switches to set up a bomb-button jettison. The twisting for vision put him in a near vertical bank, scaring him. "The heck with this stuff —I've got the field made if I pay attention, so take the tips home!"

Another airstart, another try of the button. On final by this time, still fat, but pounding his clenched hand against his helmet, wondering, straining for thought. "What's wrong with my thinking? It can't all be the Bird, I know better than that. I'm doing something wrong. What is it? Why can't I get anything to work? Never

mind, don't distract yourself. Just land the airplane and we'll figure it out on the ground. Get the gear down now, you're high and hot. Test the flaps — well, these two things are working all right anyway. Get the rest of the flaps down or you'll never stop it."

At this time, Sam was about a mile out, at 800 feet. "Never have been so high and fast, this close," he thought. Nevertheless, just moments later he was startled by his rate of descent. "I'll never make it," he thought. And with that, he pulled the gear up. The same instinct had produced a back pressure to break the descent. This was brought forcefully to his attention by a sickening burble. "Now, you've done it, you dumb cluck. A hundred feet to go, and you're already stalled. But, I've got 120 knots; it shouldn't stall yet. You're playing for your life now. Let it drop. Save the control to keep the nose out of the dirt. That's it. Play it right on down. Now, get the nose up and hang on. Stay awake. The tips will blow for sure. Get out in a hurry. Don't breathe. Flash! Fire! Wow! What a shot. Get your head up, keep it straight. No fire, yet. Full left rudder. There, she's straight. But, will it never stop?"

It did—and no fire. Sam was out in a flash. Captain McAdory, the runway control officer, came up in a screeching jeep. "You okay?"

"Rodge," answered Sam, "providing my back isn't broken." He meant it, too, and was making a cautious toe-touch check.

Captain Johnson drifted quietly into the Flight Surgeon's office. The Doc was tapping each of Captain Croner's vertebra with his fingers.

"How do you feel, Sam?" he asked quietly.

Captain Croner strained to look upward from his bent-over position. "Oh, Hi, Bill. No sweat. I got a real jolt on the first bounce but it seems to be all right."

Major Wiemer, the surgeon, concurred, but added that Sam was not to fly until after an X-ray check.

Within two hours, Captain Johnson had explained exactly why Sam had fallen short of the runway. It was as simple as A-B-C, if you had the inside story. The published speed for gliding is an optimum figure, Sam learned. The flameout procedures call for tank jettisoning, so the recommended gliding speed is selected to favor this configuration.

Gliding distance, or ratio as it is popularly known, is a product of angle of attack. Our index for angle of attack is indicated airspeed. The engineers determine the angle that has the best lift to drag ratio. (Eleven parts lift to one part drag, for example.) In the T-33 aircraft, you know this term to mean 11 miles forward, for each mile of altitude.

The engineer then determines the exact amount of dynamic pressure (airspeed) required for this angle to lift the weight selected. In consideration of the fact that most flameouts result from fuel mismanagement, or outright starvation, the weight selected is usually on the light side. The pilot's handbook then appears with a recommended indicated airspeed for gliding. Indicated speed is specified (because this is in reality a reading of the dynamic pressure present at any time) and that is what the airplane flies on. It is a fact then that one IAS will locate one particular angle of attack at one particular weight. That same angle of attack will give more lift if desired, but it takes more speed to do it. Remember? Lift increases as the square of the airspeed. You use the rule every day when you add five knots for each thousand pounds of fuel over standard, on final. You do this for the very same reason—to maintain the most favorable angle of attack for that approach.

He felt his toes and knew he was all right.

The same rule, applied to gliding speed, will make good the gliding ratio, regardless of weight. Yes, a 15,000-pound T-Bird will glide exactly as far as an empty one, so long as the airspeed is corrected to provide a glide at the one proper angle of attack.

If you glide at a slower speed, the attitude may look all right but the sink rate will be much higher. Sam Croner couldn't detect it until he was within 200 feet of the ground. Maybe you could, but as Sam puts it, it's a small point to bet your life on. Since the facts are available, it is less painful to learn the details of the profession.

The rest of the malfunctions that day took a little more time to account for. The drive shaft for the main fuel control had sheared, and the centrifugal governor had shut off the fuel flow. The cook switch, although alerted, had not detected this.

If Captain Croner had tried an emergency airstart, he'd have flown home under power. However, the emergency procedures are designed to save the majority and suggest a manual try only if there is time available after the automatic try .

How much time is time? A flameout shakes you—restart failures make you wonder—and a salvo button malfunction on top of these can break you into pieces. You get the feeling that you're running out of time. When such a compounding of mechanical failures put your talents to test, will you be in a state of mind to cope with them? ▲

PANIC-PANIC-PA

"I'VE GOT a red light on! I'm bailing out!" said the somewhat hysterical voice over the radio.

The flight leader looked around to see his Number Three man hitting the silk. The chute opened successfully and the pilot looked okay. The airplane also looked okay—no smoke, no fire or anything else. It went into a long, shallow dive and exploded as it hit the ground.

The accident investigation board reached the conclusion that the light which came on was a fuel boost light and hardly a cause for hysteria. By reducing throttle and rechecking instruments, the pilot could have returned to home plate. Or, he could have landed at an auxiliary field located less than five miles away. Even if the engine had stopped altogether, he could have made it into the auxiliary field without too much difficulty.

Why? What caused this accident? It could be summed up in one word: PANIC. This pilot was really shook. He couldn't think; he couldn't analyze, but through his state of confusion he was able to make an ejection from a jet aircraft. The basic fact that his instinct for self-preservation allowed him to operate the ejection procedure properly is a strong point. He probably went through numerous dry runs and was well indoctrinated as to what action or procedure to take when bailout was necessary, and this is good. This pilot knew the proper ejection procedure. He practiced it and knew it so well that even in a severe case of panic he did it successfully.

However, the situation of a red light coming on was new to him. Being an inexperienced pilot he became shocked—shocked into the reality that he was in danger. Immediately, he became confused and was swimming in a pool of distorted gages, procedures, questions and . . . no answers except "bail out!"

Another similar accident occurred when a pilot, while flying in a formation of four, called clearly over the radio that he had a flameout and was ejecting. The instructor tried to aid him in restarting but as he turned to help his wingman, all he could see was a big, white parachute. The flight had plenty of altitude and there would have been ample time to try an airstart; and, again, there was a field within gliding range. Why?

What caused this pilot to bail out so quickly? No attempt to make an airstart was made and yet as soon as an unusual situation happened, over the side he went!

Some troops go the other way during their panic seizure. They either do nothing at all or they do everything wrong. Their minds are complete blanks and they can't remember even the basic emergency procedures.

Panic is something we kid about and talk about, but like the weather we do nothing about it. . . . "What happened to Sam?" "He hit the panic button and bought the farm." Nevertheless, a lot of the time it's quite true. Anything different, unusual, out of the ordinary or strange, causes panic. The mind becomes confused because there isn't an immediate answer. A pilot is taught procedures until it runs out of his ears. Some—he remembers, some he partially forgets, and others he forgets entirely; thus in doing the latter, he becomes confused and often gets one procedure mixed up with another. This usually is quite true in three main cases: He is either a new pilot (one still in or just out of training), a behind-the-line pilot or a pilot flying an airplane more or less new to him. The new pilot is unsure. He is feeling his way along, like a toddler learning to walk, and almost anything will upset him. The behind-the-line or way-behind-the-line pilot usually isn't too current. He flies as much as possible, but other duties keep him strapped to a desk. He becomes careless on procedures and gets caught with his pants down. The transitioning pilot often does not know his bird. Flying an unfamiliar airplane is foolhardy, especially jets. You may get away with it for a while but take one emergency-type incident and a new piece of real estate is purchased. These three types aren't the only guilty individuals but they are the ones usually the quickest to panic.

Panic in its true form doesn't creep up on an individual or turn on an amber light to forewarn you of an impending danger. It doesn't tap you on the shoulder with a gentle hand and say, "I believe you are going to have a little difficulty, 'ol boy, let's start getting a little panicky."

Panic hits you like a bolt of lightning. It strikes unmercifully. One minute you are calm, with a light-hearted feeling, enjoying the world. Then, cold sweat pops out on your brow and you feel as if the whole world has crashed down on you. Everything closes in. You can't think. You have a feeling of icy fingers crawling up and down your spine and all that was real now turns into a nightmare. The altimeter reads in miles per hour and the airspeed indicator gives you the outside temperature. What is going on? Panic!

Panic can be combated but not while it is taking place. The antidote must be taken well in advance of the poison. Panic is brought on by ignorance. The pilot must be well versed on his airplane before he flies it. He has to have all the answers.

Probably the most outstanding problem is making sure that you know the airplane. Take a look at the Pilot Operating Procedures once in a while. Check yourself on the questionnaire and carry a little emergency procedure card with you when you fly. It is not necessary to know how many RPMs the engine turns over nor is it necessary to know the composition of a rubber type seal. But, when a warning light comes on, let it mean something. Let it tell you its little tale: "I'm a red light. You're low on fuel . . . better land!" Or, "Your boost pump is out and you'd better switch to an auxiliary tank or you're going to flame out!" That's what your lights are trying to say to you. If it is a fire, the fire warning light will tell you to "Get out!"

It's just good, common sense to learn the basic fundamentals, the operating and emergency procedures. Get to know the cockpit, make it an old friend. Call all of the gages, switches, handles and lights by name, and treat them as you would your best friend. For—unlike your friends sitting elsewhere — these items always will be around when you need them.

Above all, there is no substitute for knowing your aircraft. Being in familiar surroundings is the best way to eliminate that deterrent to common sense—Panic! ▲

PANIC-PANIC-PA

EYE IN THE SKY

Dr. Walter F. Grether, Aero-Med. Lab. WADC

Here are some interesting facts about your ability to see other aircraft. There are certain times when your eyes just cannot do the job very well.

WHETHER YOU are the pilot, another crewmember or just a passenger, you probably feel safest when the weather is CAVU and visual flight rules are the order of the day. But there is one type of accident for which your chances go way up when the weather is fair. That is the possibility of a mid-air collision.

IFR procedures are designed to keep you a safe distance from other aircraft. Under VFR you are depending on your visual powers and alertness for safe separation. Human vision is a remarkable and wonderful sense. But unfortunately it has certain weaknesses which make it unreliable as a collision warning device. This article describes the most important weaknesses of human vision as they relate to aircraft collisions. This information may help you to reduce your chances of colliding with another aircraft under VFR conditions.

Before digging into the subject of vision itself, let's take a closer look at the mid-air collision problem. Both military and civilian aviation groups have become increasingly alarmed about mid-air collisions and are working hard to find solutions. In November, 1955, the Civil Aeronautics Administration and the Illuminating Engineering Society jointly sponsored a symposium on mid-air collisions, held at Indianapolis, Indiana. From the papers presented at this symposium we can conclude that:

- Mid-air collisions and near-misses are on the increase because of increasing flight speeds and the density of aircraft traffic.
- Most collisions occur during daylight hours in VFR weather.
- A pilot may fail to see another aircraft on a collision course in time

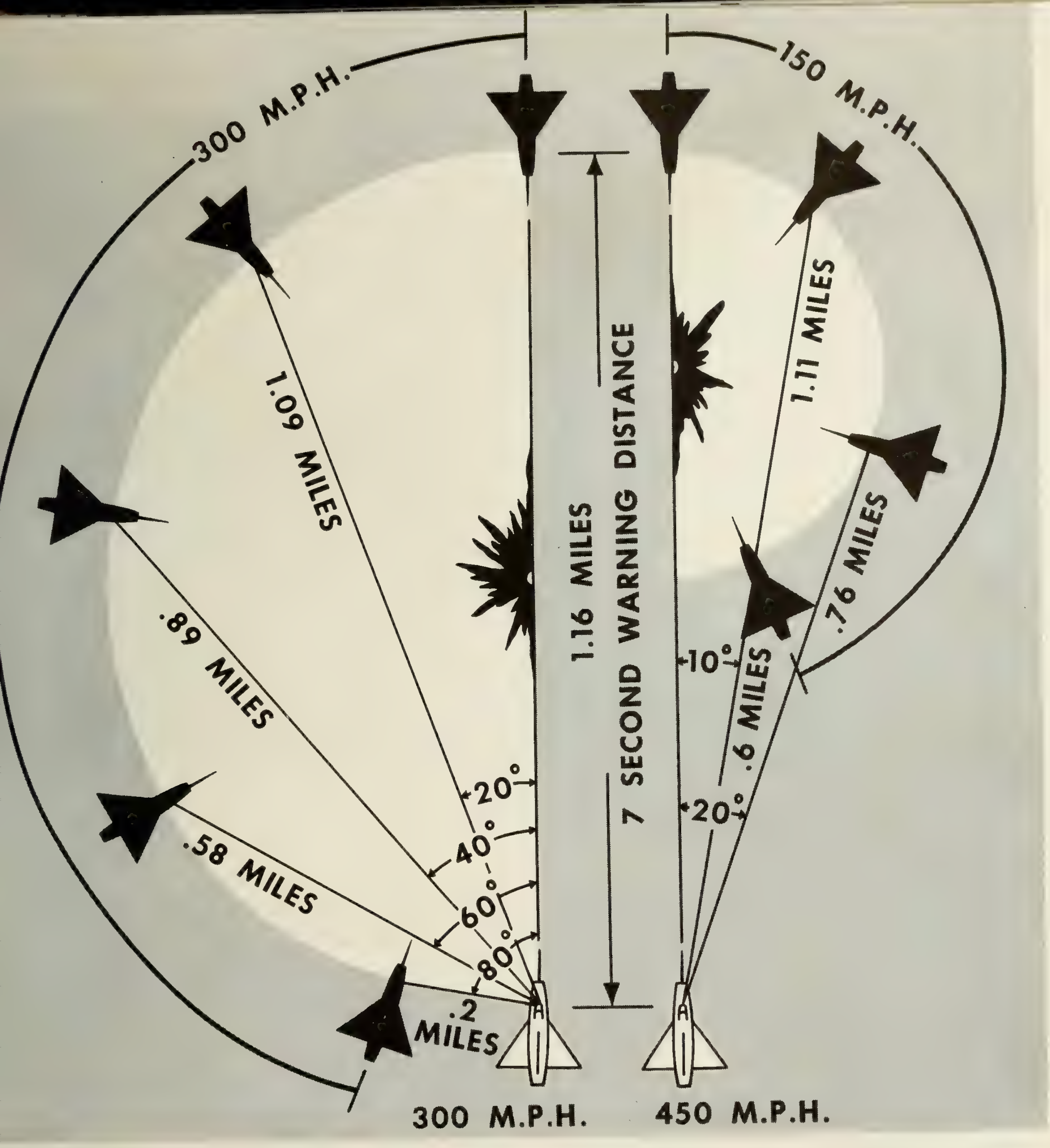


Figure 1. Distances at which other aircraft would appear seven seconds before collision for the two-speed combinations shown.

to avoid it, even though he is looking outside (rather than at his instruments) and visual conditions appear to be favorable.

It is obvious that a pilot cannot see an approaching aircraft if it is obscured by clouds or haze. Similarly, we cannot expect him to see an aircraft which overtakes him from the rear or approaches from some other direction to which he is blind (above, below or behind a windshield post). But with clear air, daylight and an approaching aircraft not hidden by a blind spot, why can we not depend on the pilot's vision to detect the other aircraft in time to avoid a collision? In most cases, of course, one or both pilots will see the other aircraft in time to take evasive action. But there can be, and are, cases where even though the pilots in both planes are alert, their 20/20 vision is not good enough to avoid a collision. Let's see what there is about human vision which permits this to happen.

Seven Seconds

First, let's examine the question of how far away a pilot must detect another aircraft in order to avoid a collision. There is no easy or single an-

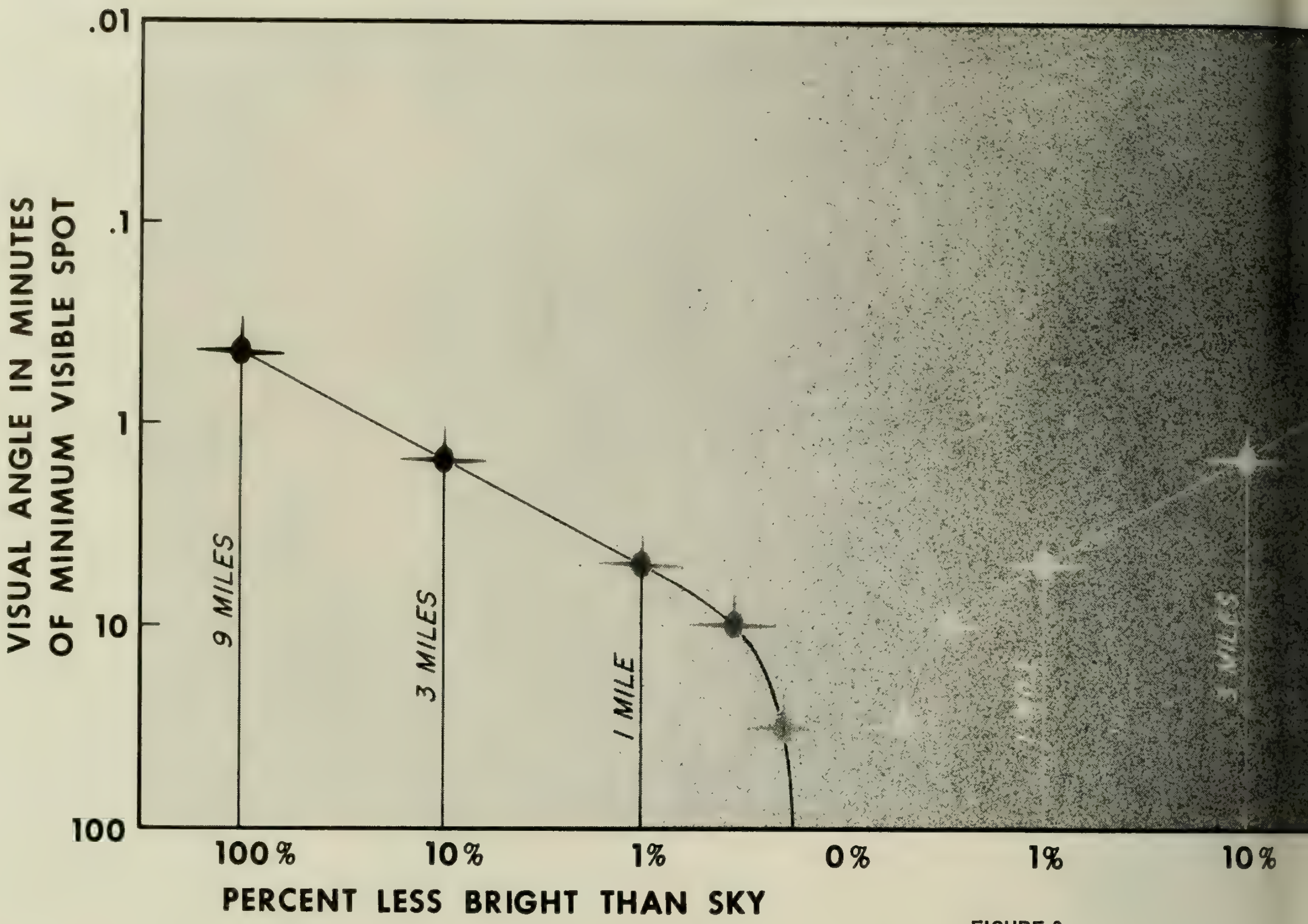


FIGURE 2

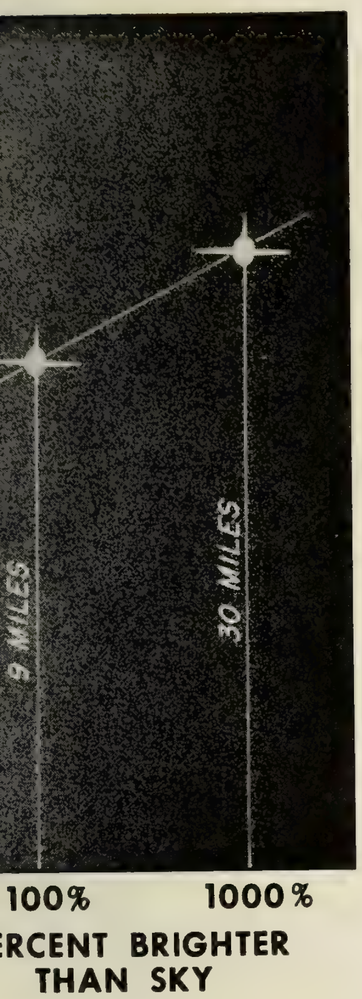
swer to this question. The answer depends on several variable factors. There is a time lag for the pilot to make a decision. There is a further time lag for the aircraft to be displaced from the line of flight. Assuming we have a large aircraft, seven seconds is a rough but reasonable estimate for the combined pilot and aircraft lag. The other variables are the speeds of the two aircraft and the flight path angles.

Distances between aircraft which will give seven seconds warning time are shown in Figure 1 for two speed combinations and a variety of flight path angles. Both speed combinations give a closing speed of 600 miles per hour for a head-on approach. At this rather conservative closing speed the head-on seven seconds warning distance is 1.16 miles. For many of our modern jets the closing speeds, and therefore the seven seconds warning distance, would be about double these values. Figure 1 further shows how the zone of greatest collision hazard changes with relative aircraft speed. The faster you fly, relative to other aircraft, the less you need worry about aircraft off to the side.

There are quite a number of factors which determine how far away a pilot can see another aircraft. Some of these factors are obvious and well known to pilots. Take size, for example. The larger the airplane the farther away you can see it. Even more important is the amount of daylight. In dim light, such as we have at dawn and dusk, aircraft are hard to see. At night we must rely on external lighting to make aircraft visible. Against the blackness of night external aircraft lights show up at a great distance and pretty well take care of the collision hazard. Against the brighter skies of dusk, dawn and daylight, however, external lights are much harder to see and are of little or no benefit for preventing collisions. Why aircraft visibility is increased by external lights at night, but not in the daytime will be explained later. Some other obvious factors which cut down aircraft visibility are glare from the sun, dirty windshields and canopies and windshield angle in relation to the line of sight.

Visual Acuity

Seeing an aircraft is basically a problem in visual acuity. For an aircraft to be visible, its angular size (visual angle) must exceed the threshold angle for visual acuity. In this case we are talking only about visual acuity for seeing a spot against a uniform background. We call this minimum visible acuity as opposed to minimum separable acuity (which applies to the minimum gap the eye can resolve). As a rough rule of thumb we say that the threshold visual angle is about one minute of arc. This means that a round spot must have an angular size of one minute at the eye in order to be visible. At one mile distance, one minute of arc is 1.5 feet. As is so often the case, we encounter some difficulties when we try to translate this rule of thumb into



size and distance for visibility of an approaching aircraft.

Aircraft aren't nice round spots and the size and shape depend upon the angle from which you see them. But let's say we have an aircraft with a 10-foot fuselage cross section, coming head-on. If we ignore the wings and tail, which add very little to visibility when seen head-on, we come close to having a round spot. A 10-foot spot will give us a one-minute visual angle at about seven miles. Seven miles is about right for the maximum distance for spotting a small to medium size aircraft, such as a large fighter. For a large bomber viewed broadside, this distance may be more than doubled.

If we can see a fighter aircraft at seven miles, then why should we have a collision hazard under VFR conditions? The one minute of visual angle and seven-mile distance apply only when we have highly favorable conditions as follows:

- We have daylight lighting.
- The pilot's eyes are focused for distant vision.
- There is high brightness contrast between the aircraft and background (sky, clouds or earth).
- The pilot is looking directly at the other aircraft.

As we depart from the above conditions the threshold angle and visibility distance will change. Most changes will be in the direction of reduced visibility distance. Only conditions which increase contrast (such as glint from the sun and external lights at night) will increase the distance.

The need for daylight lighting conditions is obvious and well known. Visual acuity diminishes as the amount of light is reduced. At night we must rely on external lights to make aircraft visible.

Not so well known is the difficulty of the human eye in focusing for distant vision when looking into the sky. To focus for the proper distance, the eye needs sharply defined objects to focus on, which are lacking in a clear sky. This focusing difficulty is usually called "altitude myopia," since it results in the pilot being focused for near vision when he should be focused for distant vision to see other aircraft. When this occurs he will not detect aircraft at maximum distance even if all other conditions are favorable.

Contrast

Let us see how visual acuity and viewing distance are affected by contrast. The approximate relationships are shown in Figure 2. By contrast we mean the brightness difference between a target spot and the background against which the spot appears. Normally this difference is expressed as a percentage of the background brightness. If the spot is darker than the background the contrast cannot exceed 100 per cent, and has a negative sign.

If the spot is brighter than the background, the contrast is positive in direction and approaches infinity as a limit. As will be seen on the graph, our rule of thumb of one minute visual angle holds only when contrast is at the highest point.

As contrast approaches zero the threshold visual angle becomes very large. At zero contrast the threshold angle becomes infinitely large, and the visibility distance for a target of fixed diameter becomes zero. As shown in the illustration the threshold visual angle becomes very small as high values of contrast are reached. In fact, the stars we see at night are effectively point sources, with no measurable visual angle.

Let's see now what kind of visual contrast values we can expect to meet when trying to see other aircraft for avoiding collisions. The background will either be earth, sky, clouds or haze, at or near the horizon. All of these may be relatively light or dark, depending on weather, time of day, azimuth angle and other factors. Likewise, the brightness of the threatening aircraft can change through a considerable range. Likely as not the other aircraft will appear as a dark spot against a lighter background of haze.

If lighted by the sun the other aircraft may instead appear lighter than the background. Sometimes glint from the sun will make the aircraft appear as a very bright spot, visible at great distance. The main point is that under some conditions the aircraft and the background will have very nearly the same brightness. This condition of low contrast means very low visibility distance. Under some combinations of lighting conditions the visibility distance will be less than the 1.16 miles required to give a seven-seconds warning at 600 miles per hour closing speed.

There is another characteristic of human vision which is probably even more important in relation to the collision hazard. This is the reduced visual acuity in the periphery of the eye. In fact our threshold visual angle of one minute holds only for a few degrees at the very center of our visual field. Go out only ten degrees from the center of vision and the threshold angle has gone up to about 10 min-

■ ■ ■

About the Author

Walter F. Grether holds a Ph. D. in Psychology from the University of Wisconsin. He has been with the Aero-Med Laboratory at WADC since 1945. In 1953 he received the Longacre Award for outstanding contributions in the design of instruments for easy reading.

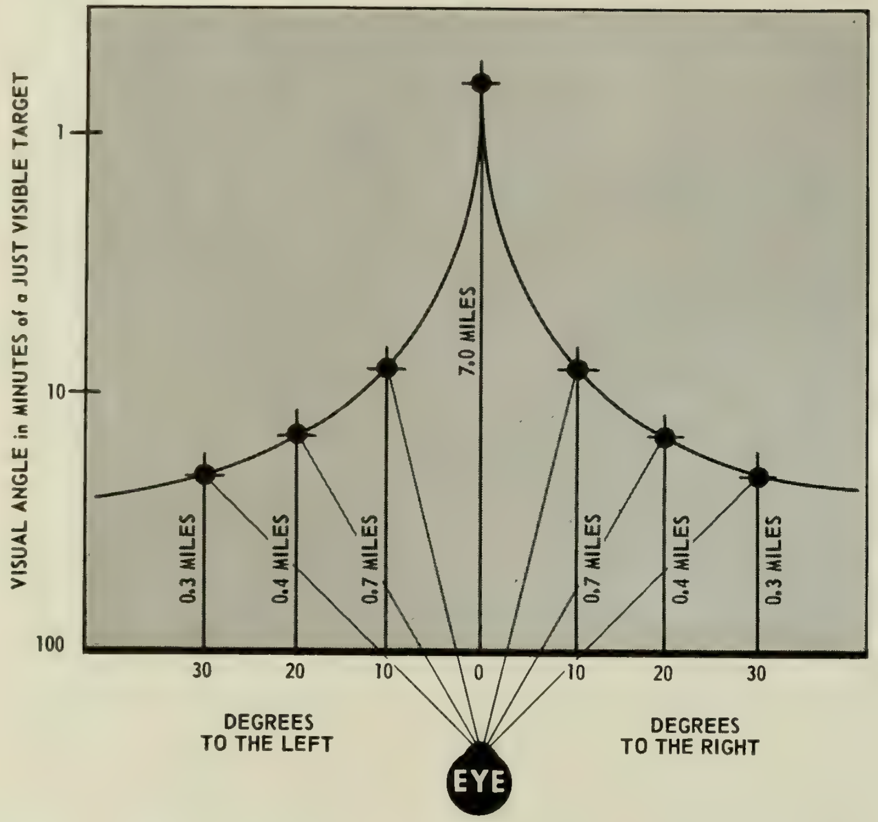


Figure 3. The effect of offset viewing angle on detection distance for fighter size aircraft.

utes of arc. At 30 degrees out the threshold angle is way up to about 30 minutes. Even this value is for high contrast. For lower contrast values the visual acuity becomes even poorer.

Viewing Angle

From Figure 3 we can see that the pilot will pick up another aircraft at maximum distance only if he happens to look or fixate his eyes within a very few degrees of its position. In scanning the sky he may easily fail to look in the particular direction from which another aircraft is approaching. Each look or eye fixation normally takes about .5 second. At very high closing speeds this means a relatively few fixations between the time another plane could possibly be seen until it is too close to be avoided. It is easy to see that there is a considerable element of chance here as to whether a pilot will happen to look at the right place at the right time. Unless he does, another aircraft can sneak in close before he will see it. Even for very favorable contrast conditions the pilot must fixate within about five degrees of a target aircraft, of fighter size, to pick it up at our critical distance of 1.16 miles. The combined effects of low contrast and off center vision give us very poor visual acuity, to say the least.

From the foregoing, it is easy to see why a pilot's vision under VFR is not an adequate safeguard against mid-air collisions. Whether or not a pilot will see another aircraft in time to avoid it will depend on the particular light and contrast conditions and the way he scans the area ahead and to the sides.

From the information about human vision presented here, what suggestions can we make for reducing the collision hazard through pilot scanning techniques, aircraft exterior points, lights or similar means?

Assuming that a pilot is alert and watching for other aircraft, there is not much more he can do, except to be sure that he makes good use of the time spent in scanning. He should scan systematically over the entire area from which threatening aircraft are most likely to come. Normally this will be the area fairly near the horizon. The distance he should scan on either side from dead ahead will depend somewhat on his own speed.

For very fast aircraft the greatest danger area is in a fairly narrow angle directly ahead. For slower aircraft the danger area extends much farther out to either side and includes the rear. The pilot should be careful to avoid spending too much time scanning a limited area, causing him to neglect other areas which should be covered.

Exterior Paint

Although exterior painting of aircraft might be considered as one solution to VFR collisions, it actually has little to offer. Black paint would improve somewhat the visibility against light backgrounds, as would white paint against dark backgrounds. But for either the black or white there will be (as for natural aluminum) some conditions of light and background where the contrast (and hence the visibility distance) is too low for collision avoidance. Use of colors—such as red, orange or yellow — likewise would not offer sufficient gain to justify their use, since, at extreme distances, the color is not visible. Even at closer range the color may not be visible if the observer sees the shaded side of the aircraft. Under special conditions of low brightness contrast, there would be some improvement of visibility from the use of colors such as orange or neon (fluorescent) red. These colors show up better than aluminum against the blue of the sky. But the overall benefits of any possible exterior painting are rather minor.

External lights on aircraft, as already mentioned, can be seen at great distances at night. Especially with the new rotating beacon type of anti-collision lights there is very little problem about VFR collisions at night.

Can lights also solve the problem in the daytime? It doesn't seem likely. The intensities required for collision lights to give adequate collision warning in daylight appear to make this solution prohibitive.

In summary, then, the human eye has some basic limitations which make it unreliable as a collision warning device under daylight VFR conditions. Very little seems possible in the way of improvement of visual detection through new or changed equipment. A better understanding of these limitations should help to avoid the hazards of mid-air collisions. ▲

Just a Triggerman

YOUR CHANCES of ejecting safely from your jet aircraft are getting better all the time. A study of 759 ejections reported through 1955 showed that 77 per cent were successful and since the advent of the automatic lap belts and automatic-opening parachutes, the odds have gone up considerably. In fact, to date, the successful attempts have gone up to 84 per cent.

This article is written to familiarize you with the various types of such automatic equipment and to impress upon you the advantages of using them. It also should serve as somewhat of a morale builder, because, with this equipment, about all you have to think of during the ejection is pulling the trigger.

In order to obtain the most advantages from the automatic features of this equipment, both the lap belt and parachute combination must be worn and properly connected. They are compatible and were designed to operate as a "team."

Parachutes

There are two types of automatic-opening parachute devices. The F-1A timer opens the parachute automatically in two seconds when you are below a pre-set altitude. This pre-set altitude is dialed into the timer by personnel of the personal equipment section, and depends on the terrain over which you are normally flying. Usually it is set at 14,000 feet above the ground.

The newest timing device is the F-1B. With this the parachute deploys one second after seat separation (below the pre-set altitude).

Regardless of the type installed in your parachute, it is the answer to bailing out—either way up high or way down low.

For ejections at altitudes where the oxygen quantity will not sustain life, the aneroid feature of the timer will allow you to free-fall and will automatically open the parachute at a pre-set altitude. It also precludes injuries associated with parachute opening shock at high altitude.

Below the pre-set altitude, the chute will open automatically in one or two seconds, following seat separation. This is much faster than you could operate it manually. Remember, however, the fully automatic features of the parachute will function only when the lap belt is opened automatically. This will be explained later. Of course, you can still operate the chute with the D-ring and you can start the automatic timer by pulling the green apple that is tied directly into the timing mechanism.

Lap Belt

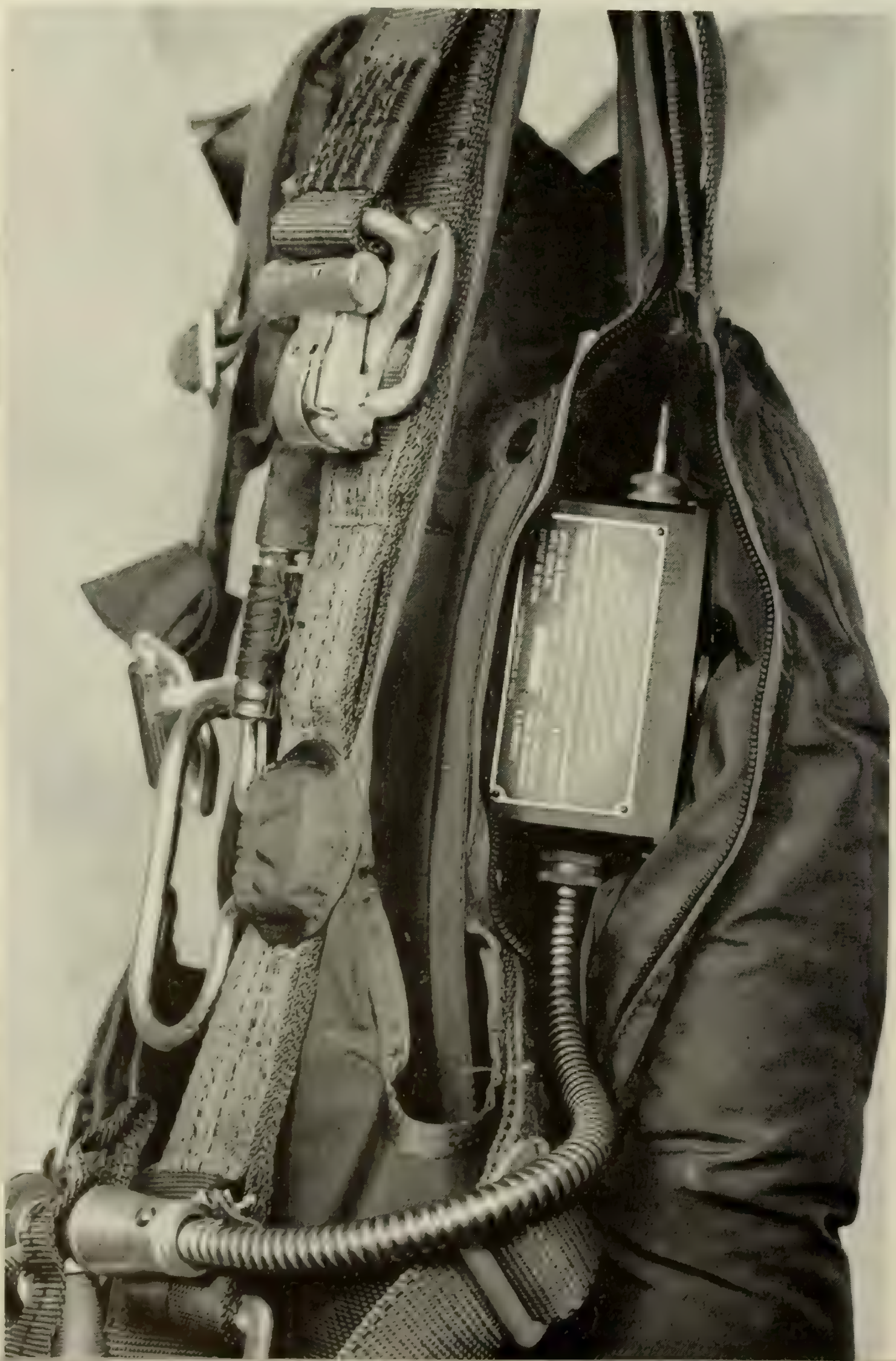
Pilot procedures in using the automatic opening parachute is not a problem. Such is not true, however, of the automatic seat belts.

There are three basic types of belts and each type requires a somewhat different hook-up procedure.

Before getting into the details of the belts, it may be in order to say that until you have become completely familiar with the automatic belt and have been convinced of its ability to do a job for you, there may be a tendency to distrust it and feel that the only way to be sure is to open it manually. This is a mistake. By manually opening the belt you destroy not only the automatic feature of the belt, but more important, you disengage the automatic parachute opening mechanism. The only way to have the automatic features of the chute going for you is by allowing the belt to first open automatically. When the belt opens automatically—and only automatically—it actuates the timing device on the parachute. When you open the belt manually you must pull the D-ring or the green apple attached to the parachute timer in order to deploy the chute.

The three basic types of automatic belts are shown on the following pages. They are the MA-1, the MA-3 and -4, and the MA-5 and -6. Each opens automatically, either one or two seconds after ejection. Whether you have a one-second or a two-second belt depends on the type of initiator installed in your aircraft. (With the M-4 initiator you have a two-seconds belt; with the M-12, a one-second belt.)

Regardless of how fast you may think you can react, you just can't open the belt faster manually than it can open automatically. And as previously mentioned, only by letting the belt open via the automatic method can you accomplish the automatic opening of the parachute.



By opening the zipper, you can identify type of timing device. If it's an F-1A, it is for two seconds; the F-1B is for one second.

The type MA-1, MA-3 and MA-4 automatic safety belts have a cartridge operated device designed for use with the same webbing as used with the standard B-18 (manual) safety belt, but differs in the center section or release portion. Upon ejection the M-4 or M-12 initiator supplies gas through a high pressure hose which actuates a piston inside the belt, retracting the latch tongue and releasing the link. The release incorporates a key which is attached to a lanyard. This lanyard is connected directly to the automatic timer of the parachute. The key is inserted in the belt-locking mechanism; thus the lanyard is anchored at one end to the belt and the other end to the parachute timer. (These belts cannot be locked without using the key. This is a feature of design so that the pilot will not neglect to tie the automatic parachute into the system. When the belt is opened manually, the key is ejected and the parachute timer is not armed for automatic operation.)

Following ejection of the seat, the belt opens but the key remains firmly locked in the belt release. As the pilot separates from the seat the lanyard actuates the timing device of the parachute, and you are in business.

The MA-5 and MA-6 belts function the same as the others; the big difference is that they are designed to retain a ring-type anchor for actuating the automatic parachute, in place of a key. This type of belt is easier to hook up because there is no need to worry about inserting the key. All that is required is to slip the locking link over the ring-type anchor (see illustration). Unlike the belts that require keys, this one can be closed and locked without the automatic chute being tied into the system.

As with this belt and all others, if the safety belt is opened manually, the parachute must be opened manually. Also, the ring-type anchor must be hooked to the belt for the parachute to deploy automatically.

Actually, the automatic lap belt and parachute have saved many a life. They have been thoroughly tested and are reliable. Take care to hook yourself into the system properly. Then, if and when you ever encounter an emergency situation and have to go—RIGHT NOW—all you need be is a trigger man. ▲

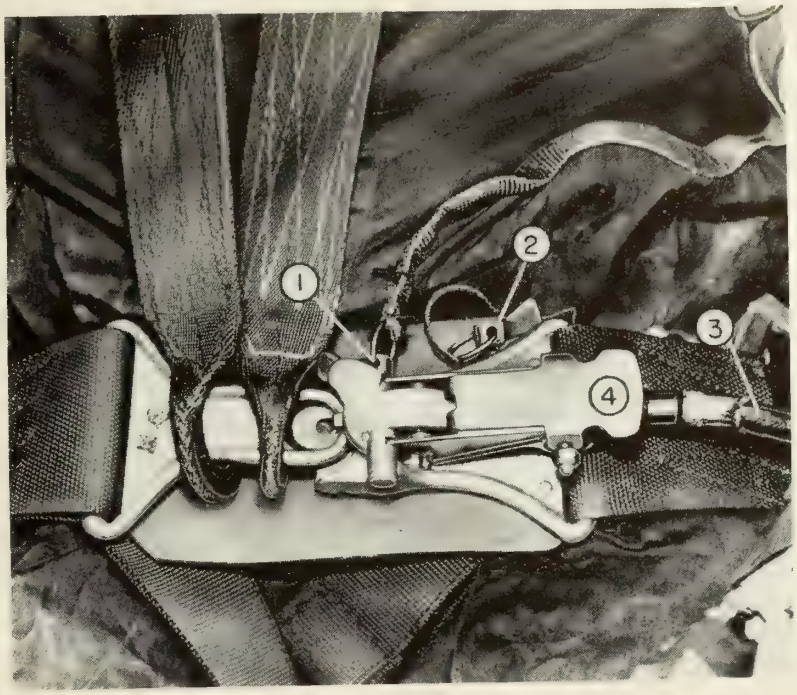
MA-1 AUTOMATIC OPENING SAFETY BELT

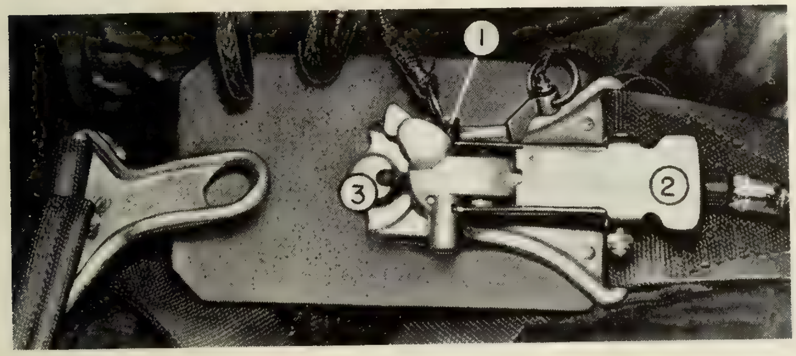
• LOCKED

1. Belt locking key (attached to automatic parachute arming lanyard) inserted in belt locking mechanism.

   WARNING

   - This key must be used when an automatic parachute is worn, in order for the parachute to function automatically if ejection is necessary.
   - Lanyard must be outside parachute harness and not fouled on any equipment, to permit clean separation from seat.
2. Belt locking key (attached to belt). Used to close belt only when automatic parachute is not worn.
3. Initiator hose.
4. Manual release lever closed





AUTOMATICALLY OPENED •

1. Belt locking key (from automatic parachute arming lanyard) retained in belt locking mechanism.
2. Manual release lever closed.
3. Belt latch opened by gas pressure from initiator.

• MANUALLY OPENED

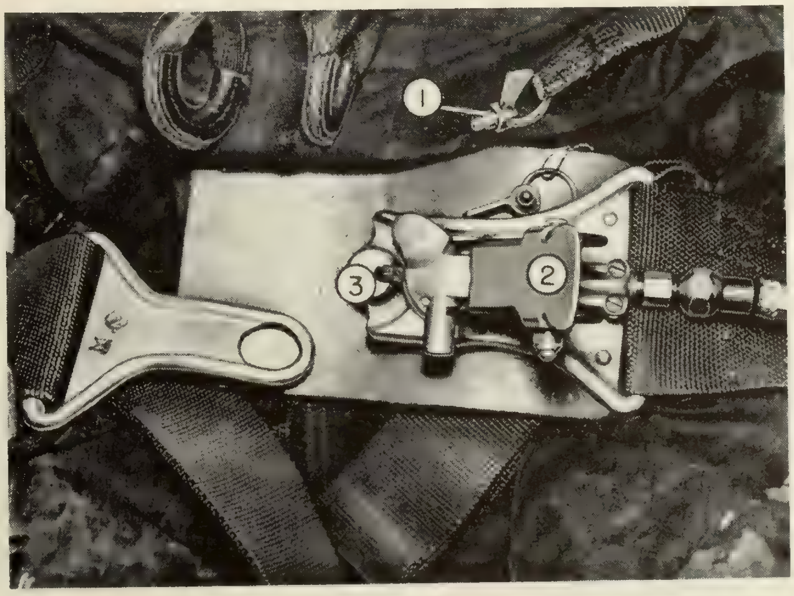
1. Belt locking key ejected from locking mechanism when manual release lever is opened.

   WARNING

   If automatic parachute is worn and belt is manually opened during ejection, parachute will *not* open automatically upon separation from seat.
2. Manual release lever opened.
3. Belt latch opened by manual release lever.

NOTE

Manual release lever can be used to unlock belt at any time, even if automatic-opening sequence already has been initiated.



MA-3 AND 4 AUTOMATIC OPENING SAFETY BELT

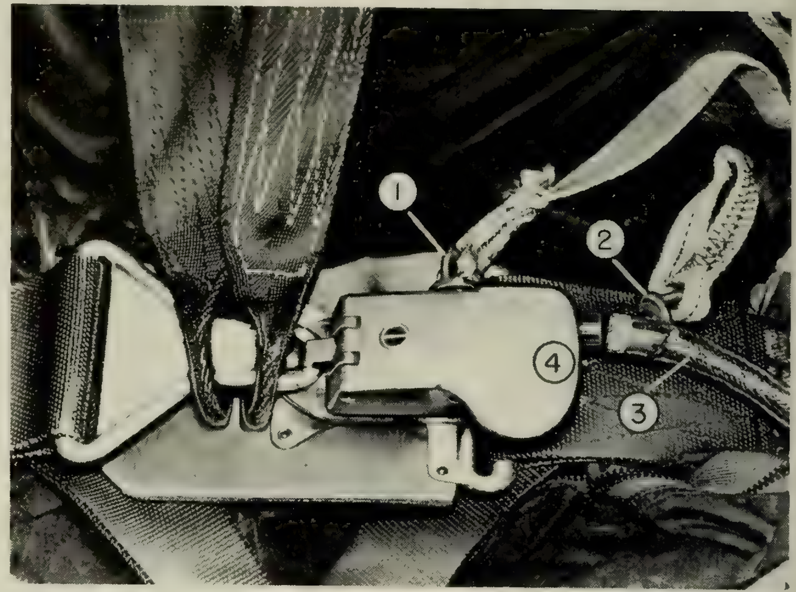
• LOCKED

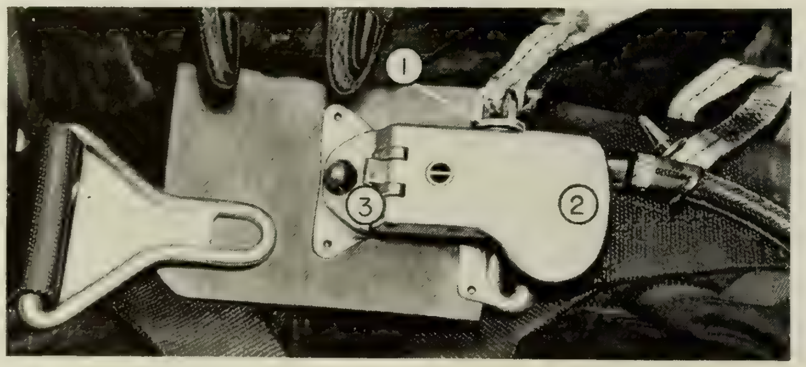
1. Belt locking key (attached to automatic parachute arming lanyard) inserted in belt locking mechanism.

WARNING

- This key must be used when an automatic parachute is worn, in order for the parachute to function automatically if ejection is necessary.
- Lanyard must be outside parachute harness and not fouled on any equipment, to permit clean separation from seat.

2. Belt locking key (attached to belt). Used to close belt only when automatic parachute is *not* worn.
3. Initiator hose.
4. Manual release lever closed.





AUTOMATICALLY OPENED •

1. Belt locking key (from automatic parachute arming lanyard) retained in belt locking mechanism.
2. Manual release lever closed.
3. Belt latch opened by gas pressure from initiator.

• MANUALLY OPENED

1. Belt locking key ejected from locking mechanism when manual release lever is opened.

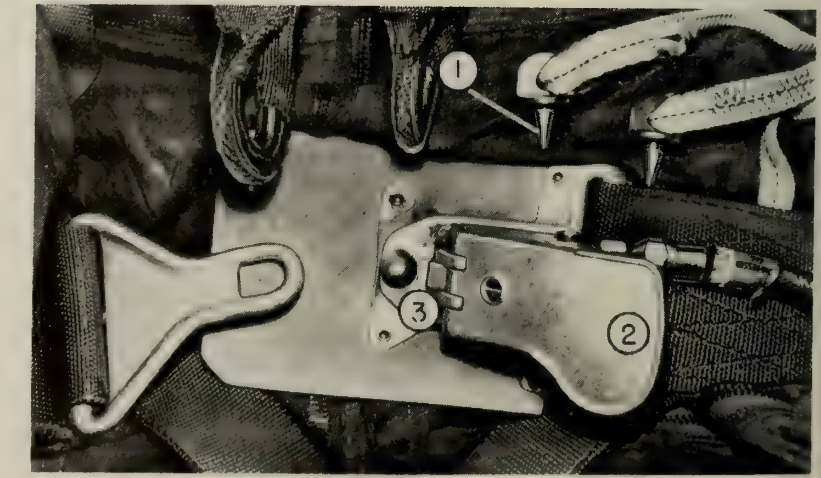
WARNING

If automatic parachute is worn and belt is manually opened during ejection, parachute will *not* open automatically upon separation from seat.

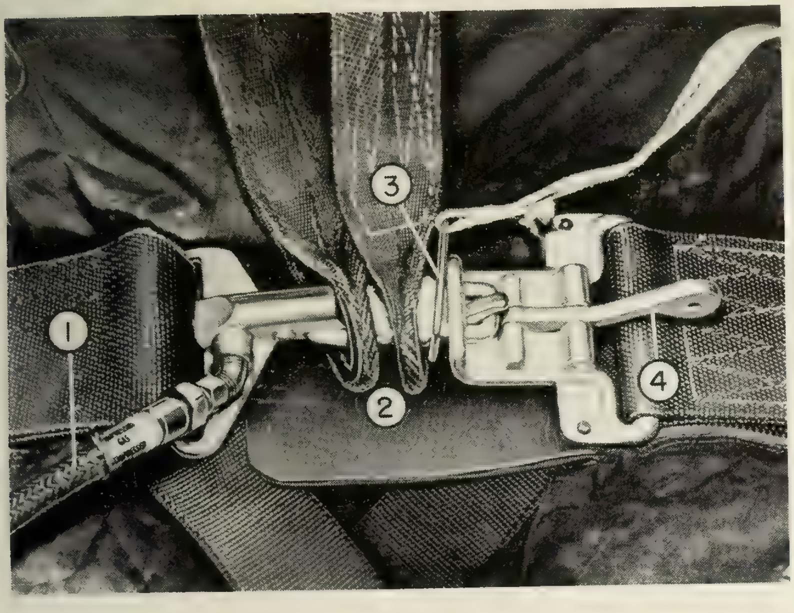
2. Manual release lever opened.
3. Belt latch opened by manual release lever.

NOTE

Manual release lever can be used to unlock belt at any time, even if automatic-opening sequence already has been initiated.



MA-5 AND 6 AUTOMATIC OPENING SAFETY BELT



LOCKED ●

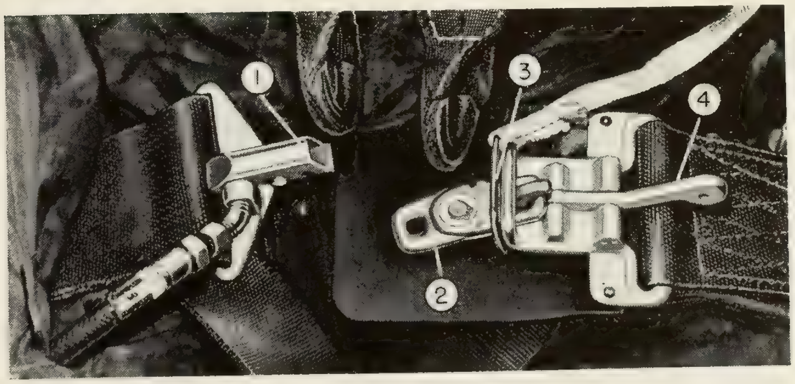
1. Initiator hose to automatic release mechanism.
2. Shoulder harness loops over swivel link.
3. Anchor (from automatic parachute arming lanyard) slipped over swivel link.

WARNING

- Although not necessary to close belt, anchor must be installed when automatic parachute is worn, so that parachute will function automatically after ejection.
- Lanyard must be outside parachute harness and not fouled on any equipment, to permit clean separation from seat.

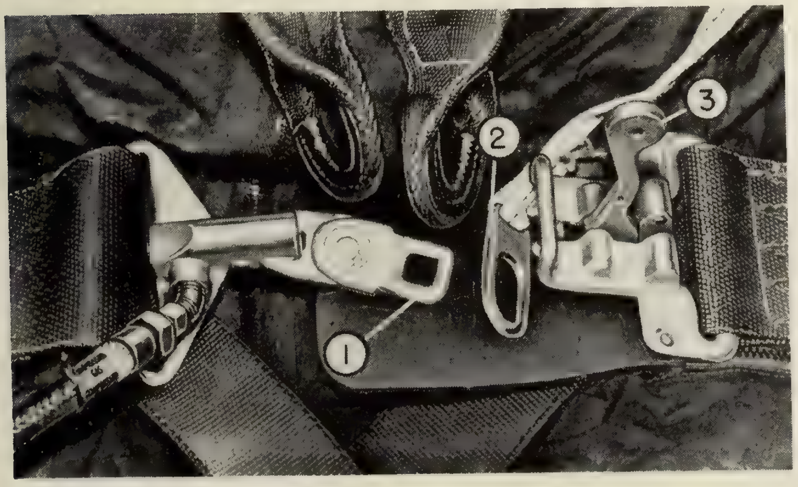
4. Manual release lever closed.

● AUTOMATICALLY OPENED



1. Automatic release mechanism actuated by gas pressure from initiator, detaching swivel link on automatic release side.
2. Swivel link retained by manual release lever.
3. Anchor (from automatic parachute arming lanyard) retained by swivel link.
4. Manual release lever closed.

MANUALLY OPENED ●



1. Swivel link released by manual release lever (automatic release mechanism not actuated).
2. Anchor (from automatic parachute arming lanyard) freed from swivel link.

WARNING

If automatic parachute is worn and belt is manually opened during ejection, parachute will not open automatically upon separation from seat.

3. Manual release lever opened.

NOTE

Manual release lever can be used to unlock belt at any time, even if automatic-opening sequence has been initiated.

. . . Miss a GCA or two after an otherwise "uneventful" cross-country and that JP-Four just seems to evaporate . . . Makes the situation seem hairy . . . Read this account by an '84 pilot, apply its principles and avoid that emergency.

What's the Pitch?

Capt. Marvin D. Williams, 81st F-B Wing, USAFE

YOU ARE FLYING your '84F in a GCA pattern prior to landing on a strange runway, with everything running according to Hoyle and looking rosy. The weather is reported 400 overcast and ¾ miles visibility; no wind, altimeter 29.90, landing runway 260 degrees, 8000 feet long, GCA minimum 300 feet and ½ mile for jet aircraft. Your final controller checks in loud and clear, and that time has come to hurtle your little pink body at the ground. He lets you know that you're approaching glide, on centerline.

Upon reaching the glide path area he asks you to set up a rate of descent for your type aircraft, suggesting 650 feet per minute, so down you go! You've decided that a final approach speed of 180 knots should be about right for the gross weight involved and intend to hang right onto it. Final control has stated that you need not acknowledge any further transmissions so you settle back to enjoy the ride to touchdown.

"Six-nine-eight, your range is four and one-half miles, heading 260 degrees. Going high on glide path, increase your rate of descent. Steer right 262 degrees, holding high on glide path. Your range is four miles, heading 262 degrees. This heading is bringing you back to centerline nicely, still high on glide path. Your range is three and one-half miles, heading 262. You're holding 100 feet high on glide path, increase your rate of descent. Your range is three miles, still holding high on glide path, heading 262. Turn left, heading 260 degrees. You're on centerline, range two and one-half miles. You're returning slowly to glide path, heading 260, range two miles. Heading 260 degrees is holding you on centerline nicely, still high on glide path. Range one and one-half miles. Turn one degree right, heading 261 degrees, range one mile, high on glide path, on centerline. Six-nine-eight, you are too high to complete this approach safely. Pull up and climb to two thousand feet heading 330 degrees. Contact approach control on channel one five. Acknowledge. Over."

The pilot acknowledges and pours on the go-juice. All didn't go so well. He established his 650 feet per minute rate of descent on schedule, but as soon as GCA said that he was going high, he changed to 950 feet per minute. At a low altitude this is a pretty rapid descent. Even at this rate of descent the pilot found that he only paralleled the glide path, so he went to 1050 feet per minute. This is a real thrill. Try it sometime. Fortunately, the final controller knew the pilot couldn't complete a safe approach, so he called it off. The pilot was most happy to comply with the suggestion and to try again.

This may seem like a far-fetched situation, but let's take a short gander at the stage settings.

This pilot's home station had a good GCA unit installed and had been working high performance machinery for a good while. A pattern had been established to comply with safe practices. One minor point that has become a major consideration in the past few years is the little difference between selection of a glide slope angle. This pilot's home station had a beautiful approach terrain-wise, the kind you dream about but seldom see. Therefore, a glide slope of two degrees was selected and this pilot had found that with this slope it took about 650 feet per minute to stay on glide path under the conditions that he flew GCA. It didn't seem out of the ordinary at all for this GCA operator to suggest 650 feet per minute rate of descent. This is the same wording which his own unit used. Much to his surprise, however, the 650 didn't work out. Glide slope angle had reared its ugly head. The strange GCA unit had worked a good number of jet aircraft but its main use was with conventional fan machinery. Its glide slope three degrees — a minor point? Let's look.

At the stated conditions, 180 knots, no wind, a two-degree slope gives you 637 feet per minute rate of descent. What does a three degrees slope do to you under these conditions? 953 feet per minute. Is it any wonder the pilot couldn't get back on the glide path? He could have made it back if he had suspected the steepness of the slope, couldn't he?

Flying a glide path is a consideration of the degrees of slope, the true airspeed and the amount of wind available. A change of five knots, airspeed or wind, will change the rate of descent by approximately 26.5 feet per minute on a three degrees slope, while the five-knot change on a two degrees slope amounts to approximately 17.2 feet per minute change.

The charts shown here involve speeds for high performance aircraft but, with a little figuring, can be adapted to any type of bird.

The degree of the glide path should be listed under "Remarks" in the Radar Section of the Radio Facility Chart. By utilizing the wind conditions and the glide slope, plus the final speed that the pilot intends to use, GCA should be a drop in the bucket. Try these charts with your GCA unit. Saving one approach would be well worth the trouble by eliminating the hunt and seek system of getting on the glide path. ▲

Rate of Descent Table

2 DEGREES SLOPE 17.226 FT/MIN FOR 5 KT. CHANGE

Kts TAS	15TW	10TW	5TW	0	5HW	10HW	15HW	20HW	25HW	30HW	35HW
175	672	655	637	620	603	586	569	551	534	517	500
180	689	672	655	637	620	603	586	569	551	534	517
185	706	689	672	655	637	620	603	586	569	551	534
190	724	706	689	672	655	637	620	603	586	569	551
195	741	724	706	689	672	655	637	620	603	586	569
200	758	741	724	706	689	672	655	637	620	603	586
205	775	758	741	724	706	689	672	655	637	620	603

2¼ DEGREES SLOPE 19.952 FT/MIN FOR 5 KT CHANGE

Kts TAS	15TW	10TW	5TW	0	5HW	10HW	15HW	20HW	25HW	30HW	35HW
175	755	735	715	695	675	655	635	615	595	575	555
180	775	755	735	715	695	675	655	635	615	595	575
185	795	775	755	735	715	695	675	655	635	615	595
190	815	795	775	755	735	715	695	675	655	635	615
195	835	815	795	775	755	735	715	695	675	655	635
200	855	835	815	795	775	755	735	715	695	675	655
205	875	855	835	815	795	775	755	735	715	695	675

2½ DEGREES SLOPE 22.214 FT/MIN FOR 5 KT CHANGE

Kts TAS	15TW	10TW	5TW	0	5HW	10HW	15HW	20HW	25HW	30HW	35HW
175	838	816	794	772	750	727	705	683	661	639	616
180	860	838	816	794	772	750	727	705	683	661	639
185	883	860	838	816	794	772	750	727	705	683	661
190	905	883	860	838	816	794	772	750	727	705	683
195	927	905	883	860	838	816	794	772	750	727	705
200	950	927	905	883	860	838	816	794	772	750	727
205	971	950	927	905	883	860	838	816	794	772	750

2¾ DEGREES SLOPE 24.229 FT/MIN FOR 5 KT CHANGE

Kts TAS	15TW	10TW	5TW	0	5HW	10HW	15HW	20HW	25HW	30HW	35HW
175	923	898	874	850	826	802	777	753	729	705	680
180	947	923	898	874	850	826	802	777	753	729	705
185	971	947	923	898	874	850	826	802	777	753	729
190	995	971	947	923	898	874	850	826	802	777	753
195	1020	995	971	947	923	898	874	850	826	802	777
200	1044	1020	995	971	947	923	898	874	850	826	802
205	1068	1044	1020	995	971	947	923	898	874	850	826

3 DEGREES SLOPE 26.481 FT/MIN FOR 5 KT CHANGE

Kts TAS	15TW	10TW	5TW	0	5HW	10HW	15HW	20HW	25HW	30HW	35HW
175	1006	980	953	927	900	874	847	821	794	768	741
180	1033	1006	980	953	927	900	874	847	821	794	768
185	1059	1033	1006	980	953	927	900	874	847	821	794
190	1086	1059	1033	1006	980	953	927	900	874	847	821
195	1112	1086	1059	1033	1006	980	953	927	900	874	847
200	1139	1112	1086	1059	1033	1006	980	953	927	900	874
205	1165	1139	1112	1086	1059	1033	1006	980	953	927	900

REX SAYS

I WAS FLYING a T-33, nearing the end of an instrument training flight. I was in the front seat, preparing to turn on initial, and as I tried to advance the throttle, found out it wouldn't move.

The throttle setting was 85 per cent as I called the pilot in the back seat and told him of the difficulty. He looked down at his throttle and found that the fluorescent light from the upper left console had come out of its bracket and had jammed in the throttle slot forward of the actual throttle. He pulled the light out and put it where it belonged, and the flight was terminated without further incident. We concluded that this light must have become disconnected because of the rough air we had encountered during letdown.

***REX SAYS** — Investigation of this incident revealed that the light was normally mounted in a socket located on the left canopy rail. Inspection showed that the friction bearing was missing from the socket, thus allowing the light to fall free with very little pressure.*

So here is something else to check in your Tee-Bird, especially if you are going solo. Give a tug on the removable lights and if they are not real secure, best remove same and stow in safe place.

★ ★ ★

MINE WAS the Number Two ship in a flight of two T-33s — both solo. We had picked up one of the T-Birds from IRAN and were returning to home base.

We decided to RON at a Naval Air Station, for which the Radio Facility Chart had listed an "Emergency Arresting Gear" on the end of the runway. We assumed this to be a crash barrier (Air Force type).

The lead ship touched down and I was right behind him. About 800 feet from the end of the runway we suddenly were confronted with what we thought was a crash barrier ready to be tripped. There were two cables lying across the runway with wood or rubber cylinders to hold them a few inches off the runway.

The lead ship and I hit the brakes at the same time. If the runway had been wet or icy, there would have probably been a pair of mangled T-Birds, with pilots to match.

***REX SAYS** — When you see the words "Emergency Arresting Gear" in connection with a Naval Air Station, don't confuse this with a jet landing barrier. The word from the Navy is that you can pass right over their cables—no sweat. So when you see those cables coming up at you, don't get shook and bust up your bird, attempting to avoid 'em.*

★ ★ ★

I WAS RETURNING from a transition flight in an F-86 and as I turned on initial as a single, was told that I was Number One following a flight of four. I approached the peel-off point and saw an aircraft on base about 200 feet below me, then loked and saw another on a wide base. I pitched out and made a wide pattern and took spacing to land on the right side of the runway. The approach and landing were normal, no comment was made throughout the pattern. On my landing roll I looked out to the left and noticed an F-86 almost in line abreast. It turned out that I had landed between the No. 2 and No. 3 men of a flight of '86s.

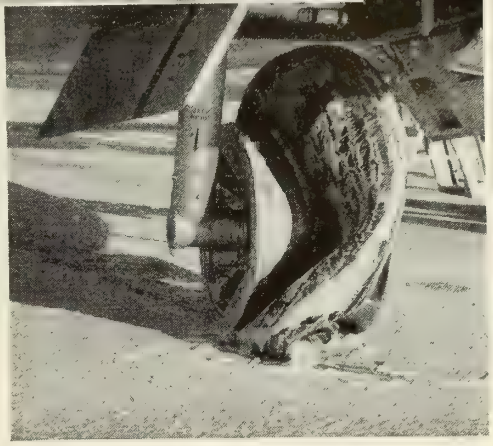
***REX SAYS** — It appears as if the flight of F86s made such a large pattern that even the mobile control officer lost sight of them. I'm certainly not an advocate of the wrap-'em-tight technique but there is a limit as to how wide a pattern should be. If a formation pitches and goes out so far that mobile can't keep track of them, that's just a hair too far.*

Quick, Gridley, check our Rex Riley posters! Maybe he covered an accident like this.

I WAS CRUISING at 8000 feet in a C-119, when, suddenly an explosive sound occurred, followed by a rushing of air.

A check was made of the aircraft and it was found that the nose gear tire had blown out and was flat. I proceeded to a nearby Air Force base to land. I notified the tower of the situation and requested that the runway center be sprayed with foam. All loose equipment in the cargo compartment was tied down and the radios were strapped into position. The extra crewmembers were instructed to seat themselves in the rear of that compartment. I was going to burn off fuel before landing but the Wing Flying Safety Officer advised that the aircraft would be more tail-heavy with the greater amount of fuel on board. Upon landing, the nose gear was held up until the airspeed was between 50 to 60 knots. I do not remember whether I lowered it or if it fell through. The aircraft was steered by use of rudders and the nosewheel steering was not used at any time during the landing roll. As the aircraft slowed down, a moderate vibration set up in the nose section and I applied brakes. All switches were then turned off.

REX SAYS*—Well, you can see by the picture that we can chock up another nice save for foam. If you have ever ridden through a nosewheel malfunction landing in a C-119, you can appreciate how foam contributed to keeping this bird in one piece.*



REX SPECIALS

THERE HAVE BEEN some reported incidents where explosions have occurred in the oxygen mask, and it was suspected that possibly the ingredients of the "Chap Stick" mixing with oxygen, caused the trouble. In order to get a firm reading on this, the Office of the Surgeon General was asked for an opinion. Here is the answer we received:

"This headquarters has no information that would relate lip ice, vaseline and similar products to flash fires in oxygen masks. The explosions involving oxygen and grease or oil, reported in the past, have all occurred when oxygen under tremendous pressure came in contact with the lubricant. Oxygen is delivered to the mask at extremely low pressures, compared to the above. Therefore, since no hazard is felt to exist relative to these products and the oxygen mask, no recommendations are made concerning materials which should or should not be used as anti-chap agents."

★ ★ ★

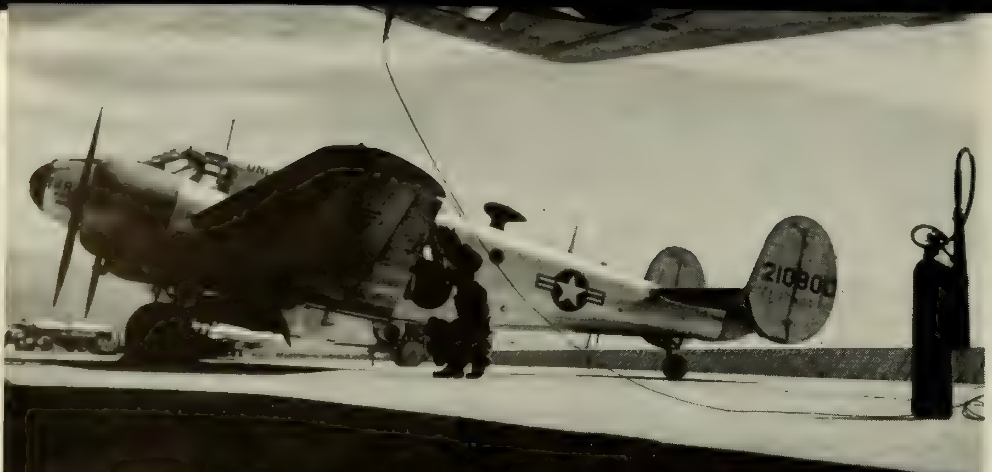
A RECENT, FATAL accident during a GCA has aroused serious concern over the lack of the pilot's ability to communicate with the controller during the final approach. With present GCA radio procedures, the pilot can not communicate with the final controller because the latter has his transmitter keyed continuously. Starting the first of this month, tests will be conducted for 60 days to determine whether or not such communication is actually required during this phase of the Ground Controlled Approach.

In this testing period, the final controller's phraseology will be: "Now on final." "Do not acknowledge further transmissions. You may contact me on this frequency any time I am not transmitting."

This means that the controller will use the conventional push-to-talk, cockpit operation. He will "un-key" his transmitter any time that an actual transmission is not required. These breaks will of necessity be brief since the controller will still be required to transmit at least every five seconds to assure you of good radio contact. During these periods you may contact him to furnish or request information pertaining to emergency or impending emergency situation, only. Otherwise, any lengthy or unnecessary transmissions may prevent his issuing pertinent instructions at a critical time.

Remember you are required to position the UHF selector switch in Transmit/Receive plus Guard position at all times while aircraft are being operated in connection with a flight. Positioning your UHF receiver in this manner will allow the radar controller to override any transmissions by you in the event that control instructions must, in the interest of safety, take precedence over any transmission you may be making.

REX SAYS*—Your cooperation in these tests and your comments—pro and con—will be greatly appreciated. They will help AACS give you better service.*



Flying the C-45H

Capt. Vernon W. Garner, March AFB, Calif.

ALL RIGHT, maybe the title does strike you as being funny but at least I've succeeded in getting you to read the first line of this article.

I suspect your first thought as you noticed the title was, "What's this magazine coming to—wasting good paper and time printing an article about that old crate?"

Every month we pick up our magazine and read some expert's advice on how to fly the latest models. And these articles are good, don't get me wrong. I never read one but what I try to apply some of the advice to my own flying, regardless of the type of aircraft. But the thought occurred to me recently that perhaps more pilots like myself would benefit from an article about the airplane that is flown most of the time.

I think I can safely say that the C-45 is the most widely used administrative aircraft in the Air Force today. And certainly, the "old crate" is what most of us staff pilots fall back on when time grows short for 60-2 requirements or when we must get checked out in something in a hurry before that birthdate comes around.

"But—what the heck—anyone can fly this thing! About 75 per cent of us were weaned on the T-9, T-10 or T-11, this isn't much different."

True, but did you ever stop to think that complacency is the pilot's worst enemy, safety-wise? Very possibly, the biggest reason for many of the C-45 accidents in the past few years has been just that—*Complacency.*

Many of us have gone from a combat crew to a staff job and consequently have gone from the B-29, B-50, B-36 or the B-47 into a smaller administrative aircraft. We pass the standardization ride okay and away we go, hot pilots once more. We log an average of eight to ten hours per month with two or three landings. Nothing to it. At least there is nothing to it until our complacency catches up with us one day and we "goof," or have an emergency.

You're flying along on a Saturday afternoon listening to the football game and you let the nose tanks run dry. ". . . Moments of sheer terror." Well, boy! This is one of them. There you were peacefully cruising along when all of a sudden you have an emergency. The terrifying quietness of both engines suddenly quitting is enough to shake the stoutest of hearts. Sure, all you have to do is reach down and turn both tanks to main and both booster pumps on. Seems like an eternity before they catch, doesn't it? And they have been known to never catch. If you're lucky enough to have them take hold, all tarnation breaks loose — props overspeed, aircraft lurches forward, to say nothing of the deafening noise. You forgot to retard the throttles which would have prevented all of this.

Then, there is the fellow who was flying over Florida one night and all of a sudden he noticed the oil temp had risen to 100° Centigrade. Nothing he could do would bring it within safe operating range, so the engine was feathered, an emergency declared and a single engine landing was made.

After checking the engines for two hours the next morning, with no clue as to the trouble, it was discovered that the oil cooler by-pass valve was open. During flight, one of the pilots had reached down to adjust the cabin heat and had mistakenly opened the valve. The pilot on this flight was one with considerable experience and thought he was real sharp — none other than yours truly.

Recently while conducting an annual standardization check, I closed the mixture on one engine to test the pilot's single-engine procedure. Everything went fine. He feathered the correct engine, until the step where the ignition is turned off. You guessed it —he turned the ignition off on the opposite engine. Again, it gets mighty quiet. So maybe he had "check-itis," but who can guarantee that he wouldn't make a similar blunder when confronted with an actual emergency.

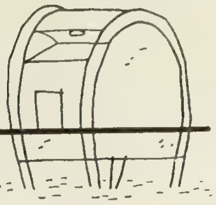
The fact that staff pilots are cast in the "unglamorous" position of flying a non-tactical aircraft is certainly no basis for relinquishing flying safety vigilance. The C-45 should be flown in no less a professional manner than the most exacting tactical aircraft.

On another standardization check flight, the pilot displayed one of the best examples of non-professionalism in flying that I have witnessed in some time. Among other things he couldn't find a published frequency in the Facility Chart; he gave an improper VFR position report and ran the nose tanks dry, causing both engines to lose power simultaneously. He was not aware that the aircraft had a low frequency command receiver installed, and descended to 2500 feet although he was cleared only to 5500. Of four attempted landings, three necessitated a go-around. This pilot had close to 2000 hours and had recently been checked out in the C-45H. And the sad part is that this chap wasn't confronted with any type of an emergency—except the pilot-induced type.

The C-45 is going to be with us for a long time. It is easy to fly and is extremely forgiving, but it expects no less than our best in performance and safety-consciousness. It is just as important to know your emergency procedures, too, because, although it doesn't make as big a splash as some other aircraft, it's big enough! ▲

CROSS FEED

LETTERS TO THE EDITOR



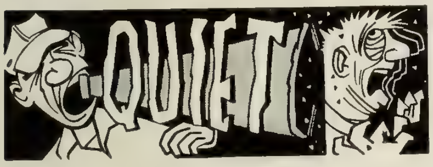
Silence

I have just read your article on "The GCA Angle" in the December issue of FLYING SAFETY.

It seems to me that if you want us to pull up and go around (unless we are VFR at GCA minimums), the simplest way to achieve this is to have the controller quit giving instructions when we reach GCA minimums.

Major Fred Peterman
Hq 16th AF, APO 285, NY.

Probably nothing would make a guy pull up like SILENCE *during the GCA final but I think the general consensus is that, just in case you have to get it, the present system is more advisable.*



★ ★ ★

World of the Warrior

The article in your February issue entitled "The World of the Warrior," infers that the Air Force is not a fighting force. There is a great deal more to the Air Force than fighting. Many of the officers must be used to procure equipment, handle money, administer the unit and perform many other tasks.

The pilot, too, is a specialist. He is paid to do his job. Each job, regardless of whether it is fighting or not, is important to the mission. We don't need the warrior to the degree he speaks of, for the weapon largely does the job. The pilot is a technician accompanying the missile. He does not need leadership as much as does the supply man or the staff officer. I resent very much trying to set a particular group up as an elite or some such thing when every officer is doing his job and is just as dedicated.

Leadership means the leading of men. It does not mean flying, or bombing — just leading men. When you finally get an airplane so technical that the presence of the pilot is a hindrance to the technical functioning of the aircraft, you can hardly list leadership as a pre-requisite. Actually the requirement for leadership is more prevalent in the ground jobs (such as adjutant, supply and maintenance squadron commander, air police) than in the air.

I suggest that we not get carried away with the belief that the pilot is something special. Such propaganda is not good for the others who also serve. I do not desire to get into any literary arguments with the author so will be satisfied with saying only that I am yours for a better Air Force.

Signed Ex-Colonel

. . . More

First, let me say that I was very interested in Col. Ritchey's article with regard to the new officer. I believe in what he says must be done, and I will be the first to sign up. The fact, however, that he recognizes the problem and that I recognize it as do many other officers, doesn't mean that it will be solved. There are just too many officers in the Air Force who are after the money, a soft job and three square meals a day, who do not want to rock the boat. It is my belief that as long as so many are motivated by that philosophy, we'll never make it.

Now, don't get me wrong. I'm an officer—at least I am what everybody chooses to call an officer these days. I am also a romanticist—enough to like the military life so long as it is military, and the heck with the welfare gimmicks. YET I'M getting out. O-U-T ! Why? Because there's no advantage to being a regular officer. I can get more real military activity in the National Guard. Since I've been in, I haven't been in one military ceremony, no social gathering where military protocol existed, no get-togethers of the squadron, and, finally, my Commander has never visited me or asked me to call, or in any way showed that he was interested in me until last month when I refused to go indefinite. At that time he called me in and said, "I'm required to interview you and try to get you to extend, however, it's probably a little late—and so on."

I could write a small book about this business but I sincerely doubt that it would be read any sooner than this letter will be published. The one thing this country needs is an Elite Air Force. Not a theoretical but a real type of fighters. If I had my choice I'd take a group of officers who weren't sure how much their pay is; didn't know when they were eligible for retirement; didn't know for sure what the emoluments for servicemen are. never read the *Air Force Times*, but instead who could fly, shoot, and were ready, willing and able to take on Ivan or anybody else when The Big Man said "go."

Yes, I liked the article, but now that the Colonel has posed the problem, is he going to come on again and tell us what to do about it? Or would it do any good?

Name Withheld by Request

. . . and More

Colonel Ritchey's article, "The World of the Warrior," published in the February issue of FLYING SAFETY, was excellent and struck a significantly responsive chord.

As Director of Operations of an Aviation Cadet Program during the Korean War, and afterwards, I found that the young man who wanted to fly and fight was our best bet. He trained harder, complained less and seemed oblivious to the pay, the G.I. Bill, retirement benefits and civilian education opportunities. Also, he sang the loudest, marched straightest, played hardest and he couldn't have cared less for PX's, Day Rooms and career incentives. He seemed to be a special breed, bent on a life of adventure with his new sky-bride in an F-100 airplane.

He is the "warrior" of whom you wrote so eloquently. We honor him by selecting him, training him and commissioning him. We insult his sense of duty, honor and willingness to fight and die for his country, by insisting that increased pay, fringe benefits and soft reading lounges are things he cherishes most.

Lt. Col. Henry F. Nau
320th Bomb. Wing (M)
March AFB. California

Colonel Ritchey's article, "The World of the Warrior," published in the February issue, has generated a bit of interest throughout the Air Force. Space limitations prohibit our printing more than these three letters; however, they represent a cross-section of the expressions and comments to the editor.

★ ★ ★

Six Bits Worth

Here is a photograph of a grim reminder to all pilots, which, if strategically located in base ops, should have a beneficial effect on all local "Mal Functions."

The construction is simple. The base is made of cardboard file dividers and scotch tape. The aircraft is a standard plastic kit, completely assembled, minus decals. To avoid bloodshed, we cut the canopy and used only the windshield. The cockpit unit had the pilots and seats cut out prior to assembly. After completion, the model was placed in a stew pan of boiling water for a few seconds (more or less) and final shape was molded with the hands. It was then cemented to the base with the same cement used for construction. Decals applied after completion.

The entire cost: about 75 cents.

M/Sgt. Richard M. Valentine
Tech Insp Div. ATC IG
Scott AFB, Illinois

Thanks for passing along the idea, Sarge. Seventy-five cents isn't much for such a grim—though effective—reminder!

★ ★ ★

For F-84F Pilots

Several months ago FLYING SAFETY published an article titled "Sizzling Strips" and referred to what is called a "well established procedure" for jet takeoffs. The first sentence in those "well established procedures" could cause takeoff accidents in the RF-84F/K and the F-84F, which are the types our unit operates. It reads: "Get sufficient airspeed working for you and then lift the nose slightly off the runway."

In the current RF-84F Pilot's Handbook, the takeoff technique set forth in Section II includes the following:

"Leave control stick in neutral until takeoff speed is reached. This reduces drag to a minimum."

In the latest RF-84F Pilot's Handbook, the above-stated step is included plus another step which states:

"When takeoff speed is reached, use necessary stick travel to pull airplane off the ground."

It has been noted within this wing that raising the nose before takeoff speed is reached, or not raising the nose high enough when takeoff speed is reached in the RF-84F/K, results in takeoff runs that are from 500 to 1500 feet longer than the computed distances. By leaving the nose on the runway until takeoff speed is reached, as indicated in the Pilot's Handbook, and then pulling back on the stick until the airplane comes off the ground, the takeoff distances required are the same as the distances computed from the handbook.

Our organization is permitted to attempt takeoffs that are computed to be up to a maximum of 90 per cent of usable runway length. Any technique that will increase the actual takeoff distance is dangerous and such a technique, as far as the F/RF-84F/K aircraft are concerned, is indicated in your article.

As an example, our runway at Larson is 10,000 feet long and we're capable of carrying enough fuel to use much more than that in the summertime. For example, a pilot computes his takeoff roll to be 9000 feet, the maximum he is permitted to attempt. During the takeoff roll he checks his acceleration 3000 feet down the runway and finds it to be normal. Then, at 110-120 knots he raises his nose off the ground six inches to a foot. This immediately reduces his acceleration rate by adding drag and will ultimately add more than 1000 feet to his takeoff roll if the temperature is high enough. By raising his nose off the ground early, the pilot has unknowingly committed himself to the barrier which (being manually operated) is kept standing at the 10,000-foot point.

On the other hand, suppose our pilot did leave the nose of the aircraft on the ground until he reached his takeoff speed and then raised it slightly. In this case the aircraft will not fly off the ground immediately and barrier engagement is imminent unless he pulls the stick back much farther in order to become airborne. This is because the RF-84F/K, as all other swept-wing fighters, requires a large angle of attack at slow speed compared to straight-wing aircraft in order to develop enough lift to fly.

We desire that your article on "Sizzling Strips" be corrected to indicate that the "well established procedure" outlined therein is not applicable to the F/RF-84F/K aircraft. It may be advisable to do more research in the Pilot's Handbooks and determine all the aircraft for which that procedure is not recommended.

Capt. William D. Baisley
71st Strat. Recon. Wg. (Ftr)
Larson AFB, Washington

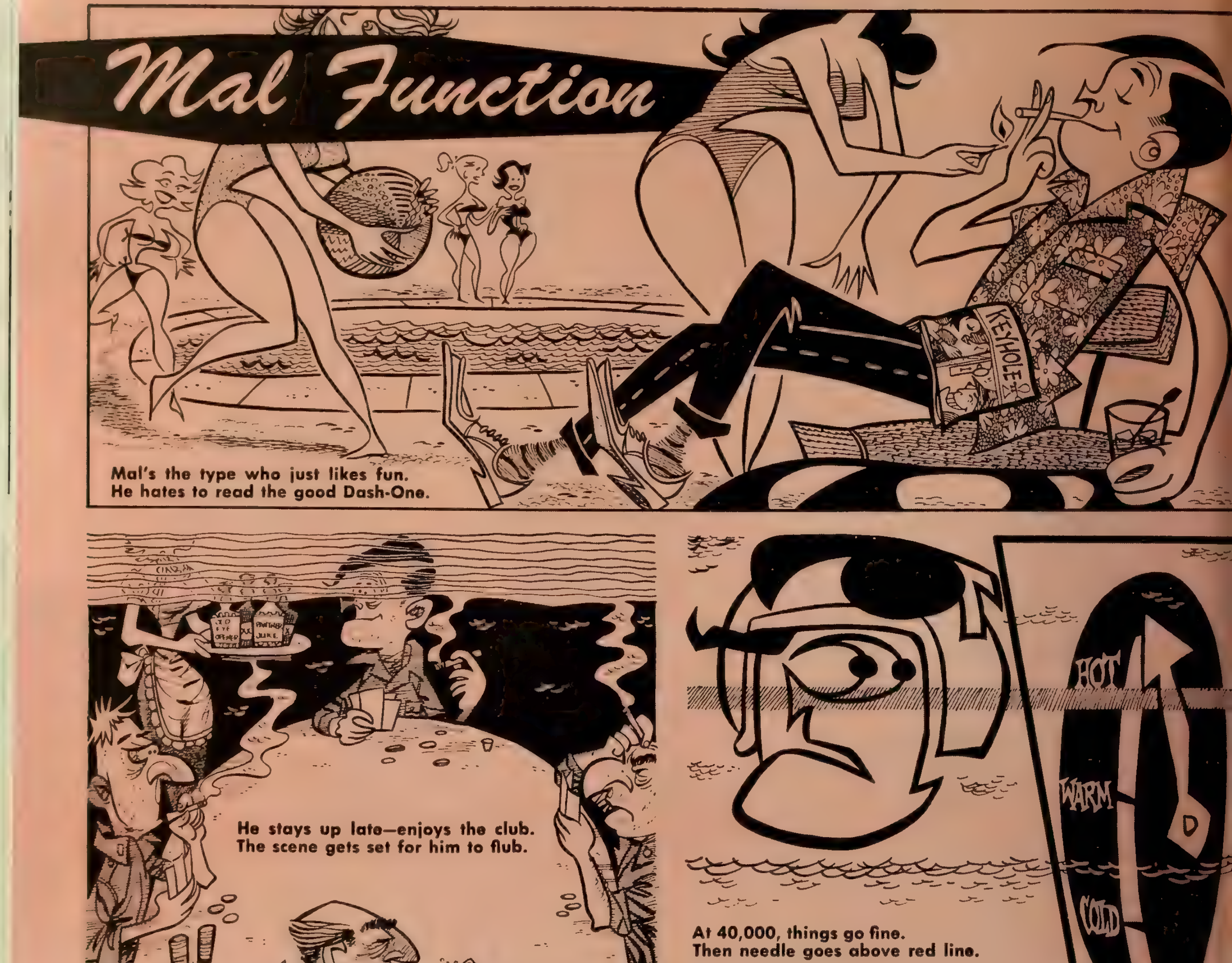
Thanks for the info about the '84F.

E is for emergency

And the surest, safest way to cope with an emergency is to know your equipment. Keep a copy of your questionnaire handy and review it often. Also, go through the Dash-One occasionally, and while you're sitting in your aircraft, mentally practice the emergency procedures.

Oh! The gal is Dani Crayne.

Mal Function



Mal's the type who just likes fun.
He hates to read the good Dash-One.

He stays up late—enjoys the club.
The scene gets set for him to flub.

At 40,000, things go fine.
Then needle goes above red line.

Main fuel control has gone askew.
Mal's mind's a blank—oh, what to do?

So Mal ejects, his nerves all frayed.
On "emergency system," he could have stayed.

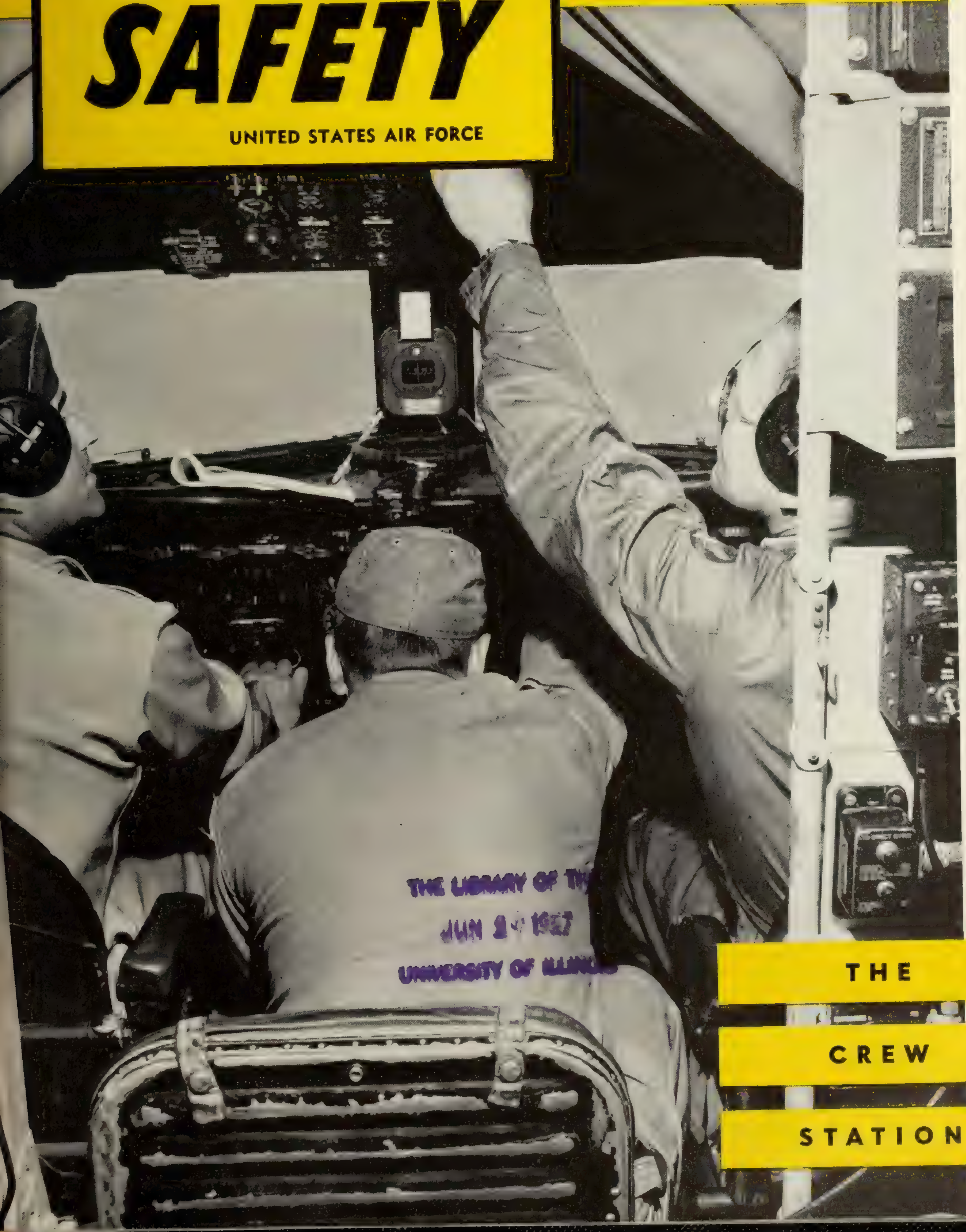
U. S. GOVERNMENT PRINTING OFFICE . . . 402042

1.130
YS

FLYING SAFETY

UNITED STATES AIR FORCE

JUNE
1957



THE
CREW
STATION

THE LIBRARY OF THE
JUN 2 1957
UNIVERSITY OF ILLINOIS

File Thirteen

I would like to quote some information recently received from the Aero-Medical Safety Division of this Directorate: "A spot-check of a unit operating jet aircraft revealed that of the 76 pilots who were issued helmets and masks, 34 had returned the masks to Personal Equipment for cleaning within the past 30 days; 15 pilots were using masks that had not been cleaned within the past 30 days; 10 were 60 days overdue, nine were 90 days overdue and eight pilots were using masks that had not been cleaned within the past 120 days. T. O. 15X-1-1 requires that oxygen masks be inspected every 30 days. Experience has taught us that masks which are used every day should be checked every 10 days." So be sure that your mask is being properly inspected. . . . In a recent aircraft accident, the pilot was (supposedly) at the Minimum En Route Altitude on airways. Actually, he was 15 miles off the airway and he hit a mountain. Subsequent inquiry among pilots indicated that many of them did not realize that the MEA provides terrain clearance ONLY FOR THE WIDTH OF THE AIRWAY. Check with your Flying Safety Officer for more details about this accident. The whole story will be included in the June FSO Kit. . . . For the latest procedure in getting your radar advisories from GCI, check the latest Radio Facility Chart. The call sign is now "Stargazer."

'til July,

Perry J. Dahl

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Please send Flying Safety Magazine for one year to the following address. Enclosed is a check or Money Order for $2.50. ($3.50 for foreign mailing.) Catalog No. D-301.44.

Name____________________________

Address____________________________

City______________State____________

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major Vernon R. Stutts

Associate Editor
Major James W. Bradford

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby

Editorial Asst.
Amelia Askew

Distribution
T/Sgt. William H. Johnson

CONTENTS

Deception on The Skyways 2
What Did He Say? 6
Aircrew Coordination 8
The Party Line 10
Cockpit Daze 13
Keep Kurrent 14
The Alpha Gage 16
Springing the Trap 20
How Well Can You Remember? 23
Rex Says 24
Crossfeed 27

VOLUME THIRTEEN NUMBER SIX

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

Use of funds for printing this publication has been approved by the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use in oder to obtain the most recent developments and to insure complete accuracy. The contents of this magazine are informational and should not be construed as regulations, Technical Orders or directives unless so stated.

USAF PERIODICAL 62-1

the first...

...and last

The first half of our yearly Flying Safety Program has ended. The purpose of the entire program is to concentrate on the known causes of the majority of our aircraft accidents. The specific cause factors, discussed each month, are realistic, for they are based on actual statistics. With everybody's cooperation, this approach should reflect favorably on the accident picture. The subjects featured in the first period were The Supervisor, The New Pilot, Your New Aircraft, Flight Planning Today, The Emergency and The Crew Station. They are all in the "personnel error" category.

★ • • • • • • • • ★

During the next six months, we plan to publish articles about other predominant causes of aircraft accidents. Here are the subjects listed by months:

- July— "Power Plant"
- August— "Personal Equipment"
- September—"Maintenance Today"
- October— "The Skies"
- November— "Most Probable Cause"
- December— "Military Flyer"

To achieve our accident-prevention goal, each officer and airman must contribute to the program . . . for "The Prevention of an Aircraft Accident . . . Doesn't Happen by Accident."

Evolution did n

Deception Rides The Skyways

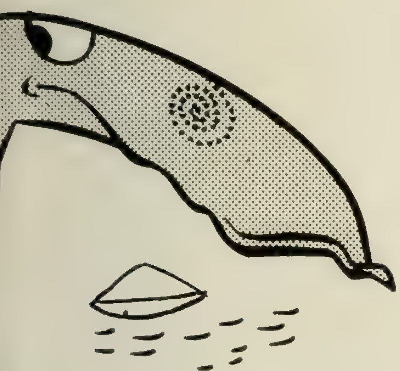
Jeff Sutton, Research Engineer, CONVAIR, San Diego

"I BECAME disoriented while descending through the clouds, lost control during transition to instruments and went into a split S. The altimeter read 200 feet just before I blacked out in the pull-up . . ."

This pilot lived to tell about his illusion. Until rather recently the word "illusion" was one for the clinic and musty books on psychology. But, suddenly, it has become important in aviation lingo, the recognized ghost behind numerous aircraft accidents, a common cause behind the label "pilot error." It will become more important as aircraft performance advances.

Despite this, we fail to tell the pilot all we know about illusions or even to pound home the simple rules which will give him an edge over the situation when it does occur. Fortunately, some pilots learn to recognize and even anticipate the onset of certain

ticipate the above mach aircraft that rove today's skies . . .



kinds of illusion. Others fly into the never-never land of complete disorientation with little or no awareness of what is happening or what to do when it happens. A few pilots appear highly immune; others appear particularly susceptible. But one thing is certain: Sooner or later every high performance fighter aircraft pilot will face frantic, terrifying seconds during which the human brain loses all contact with reality, when the objective world is completely cut off. It is a life-or-death moment.

Many pilots, aviation writers and other aviation personnel use the word "vertigo" to describe disturbing, confusing or just plain disorienting effects of all kinds. The word performs a disservice. Its generality masks the fact that certain types of illusion accompany certain types of aerial maneuvers or visual fields. Consequently, the specific course of action required to combat one type of illusion might not hold for another; it might even be very bad. Of course, not all illusions are clear-cut entities. A number of different illusion-producing factors may combine to form a diffused, generalized pattern of total disorientation —a fabric of mental chaos.

The occurrence of illusion is due to an inadequate frame of reference, ordinarily provided by the eyes, two different equilibrium senses in the inner ear, and pressure and tension senses distributed throughout the body. But it's the eye and inner ear organs—the semi-circular canals and otoliths—which are most important. The canals give the perception of rotation; the otoliths inform the brain of body attitude relative to the direction of gravity as well as changes in linear acceleration.

Two Conditions

In general, most illusions can be pinned down to two conditions:

- Accelerations which produce inner ear effects.
- Absence or reduction of cues in the visual field.

Or, these conditions may combine to create real chaos. Fatigue and emotion (primarily fear) intensify illusory disorientation and add to the general disruption in pilot performance. Illusions produced by these conditions are sometimes classed as visual and non-visual, although components of each may be present during a single generalized period of disorientation.

"I couldn't tell which lights were stars and which were fishing boats." The reporting pilot was the victim of a visual illusion. He had been flying over a calm sea on a clear moonless night and had lost his horizon. Familiar visual cues were absent. The sky and the surface of the sea had become *one*. He felt as if he were in the center of a great orb whose surface was sprinkled with lights, and direction had ceased to exist. But he was smart. He went on instruments and he lived to tell the story.

Visual illusions appear to be somewhat less common than the non-visual variety but are not, perhaps, less dangerous. They occur because visual cues are misinterpreted—conditions favored by night and weather formation, lost horizons, and dim and unflickering lights pinned against dark, unstructured backgrounds. They involve errors in interpreting the meaning of lights or seeing lights under conditions of poor depth perception. A pilot may judge inclined cloud banks as being horizontal and respond by changing the attitude of his aircraft. A wingman may interpret his own motion as motion on the part of the flight leader. These are the things of which accidents are made.

The pilot who "joins up on a star" or sees a light split asunder (double vision associated with fatigue) is experiencing visual illusion. Lights are highly important to the pilot. They form the major part of his night visual field. But they can be friend or foe. On the whole, they're tricky. Errors in their recognition, perception and relative movement are common.

". . . frantic, terrifying seconds . . ."

"I couldn't tell which lights were stars and which were boats."

The autokinetic illusion offers an example. The pilot who fixates a steady light against a dark background may see it appear to move in random fashion. Woe is he who tries to track it! This effect can be demonstrated by staring for a few moments at a fairly bright and relatively isolated star. Some pilots have reported the effect from airport lights during night landing approaches; others have reported it at altitude during night formation. Apparently, blinking lights do not always destroy the effect; and it's the exceptions that hurt.

"I thought I was flying straight and level but my instruments indicated a diving bank." Fortunately, this pilot believed his instruments. Not all pilots do. Illusions of this type, involving attitude and motion, appear extremely common—and dangerous.

This kind of disorientation usually develops under instrument flight (IFR) conditions or when the visual field is cut down or unstructured. Lack of visual orientation throws the load on balance mechanisms of the inner ear. Unfortunately these and other body equilibrium senses were designed for the slow-tempo life on good old terra firma. Evolution did not anticipate the above-Mach aircraft that rove today's skies. These senses weren't designed with high-speed aerial maneuver in mind. Their functions are dubious when such conditions pertain.

Inner Ear

The semi-circular canals lie roughly at right angles to one another in the non-auditory labyrinth of the inner ear. They are filled with fluid which, when moved, bends tiny hair cells which transmit direction to the brain. They tell you when you're rotating. During prolonged spin the fluid movement stabilizes and the sensation of rotation is lost. Conversely, during sudden deceleration in spin, inertia of the canal fluid bends the hair cells and gives the sensation of turning in the opposite direction. The otolith organs of the inner ear also act on the inertia principle. They are small calcium carbonate crystals set at the tips of tiny hair cells. During acceleration the inertia force of the crystals bends the hair cells and—presto!—a message. But its contents may be all haywire.

The inner ear organs have a low threshold of tilt, about 2 degrees/sec/sec. Consequently, if the aircraft rolls to the left, for example, and recovers slowly, the vestibular organs will not record the recovery. The pilot—if he is not instrument-wise—will believe that he is still in tilt. Or the plane may roll so slowly that the changed attitude is not recorded. If it recovers rapidly, the pilot may sense that recovery was from level position, and thus believe that he is in tilt when actually he is straight and level. These illusions are called the leans; they can be deadly. Illusions arising from skid likewise involve the misinterpretation of inner ear cues.

Many pilots are familiar with the graveyard spiral. Following recovery from spin, the illusion of turn in the opposite direction can be so compelling that attempts to correct, put the pilot back into the original spin—perhaps into a spiral too tight for recovery. But straight and level flight also has its perils, especially when the visual field is blanked. Sudden acceleration gives the illusion of climb, abrupt deceleration, the illusion of dive. These effects are characterized by subjective feelings of realism. They seem to be the real McCoy, but your instruments say otherwise.

Many illusions are of the mixed variety—visual, vestibular and somatic components are involved. The reduction of visual cues gives the vestibular and somatic senses a strong pipeline to the brain, too strong for the eyes to over-ride. The oculogyral illusion is a good example.

Following spin or during abrupt deceleration in spin, objects in the visual field may appear to rotate about the pilot in the opposite direction. The illusion is related to nystagmic sweeps of the eyeball (slow sweeps with rapid snap-backs) which result from angular acceleration.

Another illusion, the oculogravic effect, involves both apparent motion and body displacement. A pilot may feel that he (and consequently his plane) is changing attitude while, at the same time, objects in the visual field appear to possess related movement. The sensation may occur in reverse when the pilot comes out of a spin. Related illusions are those which give the sensation of climb while banking, or the sensation of dive while recovering from a spin or dive. The force of these perceptions may cause the pilot to correct automatically—a good way to become a statistic.

"I bent over to tune in the radio compass. When I straightened up I was dizzy and disoriented." The pilot making the above report offers a good example of how sudden head movement produces illusion. Head movement made in a plane at right angles

"Woe is he who tries to track it!"

to the plane of positive rotation can result in violent dizziness and nausea, the well-known coriolis effect. A pilot can achieve this by the simple expedient of bobbing his head up and down during a spin. But don't try it. At least not when you're airborne.

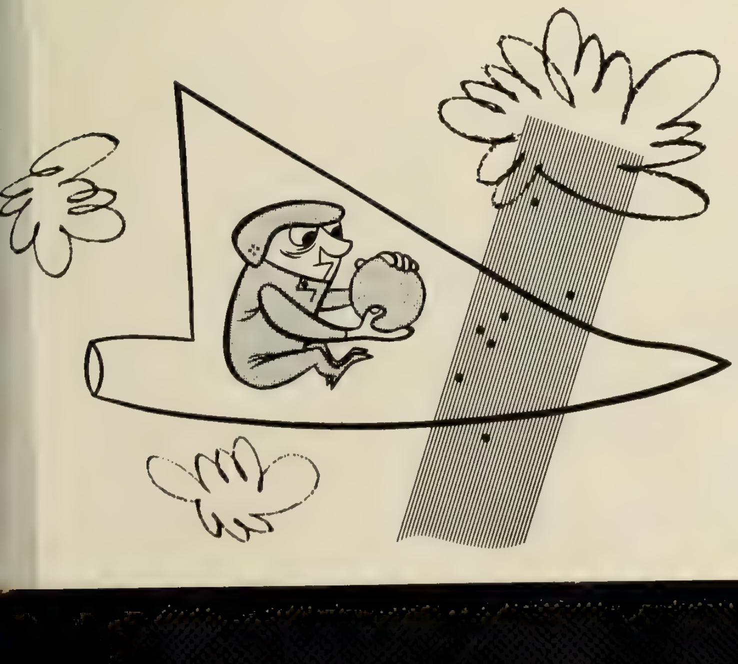
The examples given are representative of common types of illusion with which pilots should be thoroughly familiar from earliest preflight days. Illusions of attitude and motion can be induced easily on rotating chairs, centrifuge devices and Link trainers. Beginners, and even experienced pilots should be exposed to artificially-induced illusions until they are thoroughly familiar with their characteristics. The pilot should be able to assess the probability and kind of illusion which might accompany maneuvers under given conditions. He should know when and how to go from contact to IFR (there is danger in sudden transition), he should be taught to keep his eyes moving, scan instruments with least possible fixation time, avoid sudden head movements and, most importantly, to trust his instruments. Intuition and subjective impressions (when high accelerations and poor visual conditions are present) are about as reliable as the well-known crystal ball.

Training Aids

Training aids should include diagrams of the inner ear to illustrate function of the semi-circular canals and otoliths, and how these organs respond under various inertia loads. Such visual aids should help the pilot understand the origin of illusory sensations in flight. Finally, the pilot should be taught to act without hesitancy (shift to instruments) when conditions requiring this are suddenly imposed, even if unplanned. He should know the danger in flying half instrument and half contact during marginal or IFR weather. This is a sure illusion-getter.

He should learn to refer to instruments during night visual flight rules weather. Above all, he should know that some illusions herald their arrival with unmistakable symptoms. But others come unobtrusively—upon the velvet feet of death. ▲

"Intuition and impressions are about as reliable as a crystal ball."



Crew coordination is a must with today's multi-place aircraft. Orders given by the aircraft commanders must be clearly understood, for one mistaken word or gesture can result in a busted aircraft.

what did he say?

Captain Raigh Mason, Stead AFB, Nevada.

FLYING TIME per se is not an indication of correct inflight communications procedures. Many aircrews have been using incorrect techniques for years and getting away with it, but the next paragraph relates an example of why you can't be too careful when it comes to yakking over the "intercom."

An aircraft commander was herding his C-124 down the final approach and as the approach progressed, it suddenly became obvious that he was much too short. He called to the engineer for "takeoff power" and the panel man did just that. He took off the power. And the aluminum overcast grated to a stop, considerably short of the runway.

Different Meanings

It is unfortunate that so many people fail to realize that the same words or actions, in the same continuity or context, often have different meanings when expressed or interpreted by various individuals. If a man flies for some time with the same co-pilot, flight engineer or navigator, he gets to know them so well that he fully understands their special uses of words and gestures. He knows that certain members of the crew are dependable or undependable, quiet or talkative, bashful or boisterous, excitable or phlegmatic, and this knowledge is a help to him when interpreting their communication processes. With such a crew, a great deal of the communication may be unspoken. Frequently it will consist of overt body motions, such as hand signals, a shrug of the shoulder or a nod. However, such indistinct methods of communication should be held to a minimum, even among familiar crewmembers.

On "pick-up" crews the confidence, familiarity and teamwork that ordinarily comes from flying together, is not strongly developed and unless each man is carefully briefed on the use of signals, oral or visual, there is a good possibility for some sort of communications failure.

With the high speeds of our newer aircraft, even less time is available for making decisions and passing pertinent information on to crewmembers. Failure to communicate effectively (due to human error) may lead to indecision, delay, failure to accomplish vital procedures, errors in procedural or emergency techniques and panic. Errors resulting from such discrepancies generally fall into three categories, namely, when the communication is *insufficient, excessive or misinterpreted.*

Typical Cases

Let's check a few typical cases resulting from insufficient or inadequate communication.

The Hold-out or Silent Type: The commander of a four-engine aircraft was informed by ground facilities of another aircraft in the same area at the same altitude. Neither the aircraft commander nor the copilot alerted the other crewmembers of the presence of this other airplane. The personnel in the aft of the plane failed to exercise the required vigilance and shortly thereafter—crash!

There were several fatalities, and both aircraft were destroyed. Suppression of information by the pilots, which was vital to the safety of the crew, was responsible for this accident. True, the crew should have been watching for other aircraft but a little reminder may have paid big dividends. All of us get a little drowsy or careless occasionally, and assuming that all crewmembers are really alert can be a fatal assumption.

Too Busy to Talk: In a four-engine aircraft accident, none of the crewmembers informed the passengers that a crash landing was imminent, although six minutes elapsed from initial engine failure to ground impact. Unwarned, several fatalities occurred because the passengers did not have their safety belts fastened.

The pilots stated that they were so busy performing emergency procedures they didn't have time to alert the passengers. A lot of emergency procedures can be accomplished in six minutes and still leave time for a few words on the interphone.

One wonders . . . were the crewmembers inadequately trained in emergency procedures? Didn't they fully realize their responsibility to all passengers? Or did they become just flat panicky?

Feather-Heads: In a twin-engine aircraft, one engine was lost on takeoff. The pilot calmly feathered one prop and the copilot happily feathered the other. Both were apparently puzzled because the plane stopped flying. Since the boys weren't speaking to each other, no corrective procedures were accomplished and they landed in the drink. They swam out of this one.

The major cause of this accident was the failure of those individuals to inform each other of the emergency and the action taken. Such communication negligence in the air can lead to trouble. You've got to "get the word" to all crewmembers.

Too many accident reports contain such statements as these:

- The number of radio transmissions and the manner in which they were made, added to the confusion and were a contributing factor to the accident.
- Excessive interphone communications hampered crew effectiveness and increased confusion.
- Considerable confusion was created when more than one agency gave instructions to the pilot.

Too much chatter from either the outside or inside sources can create as serious a situation as too little communication. The files at Norton AFB contain many reports of accidents similar to the ones following:

Too Many Cooks: A big-busted bird encountered engine trouble. The copilot was talking to four or five ground stations. The pilot of a nearby aircraft was suggesting emergency procedures and some crewmembers of the disabled bird were contributing their ideas. The aircraft commander was getting all kinds of conflicting advice from too many sources and this resulted in a state of confusion. The entire crew bailed out.

Investigation revealed that the seriousness of the emergency had been magnified and that the plane could have been landed safely by using standard emergency procedures. It is easy for any of us to become a little confused and perhaps overlook important items when five or six people are screaming at us. Although everyone contributing advice meant well, they only added to the difficulties and confusion of the situation. Excited and confused by conflicting suggestions, the aircraft commander took the wrong advice.

Panic: The pilot of a twin-engine aircraft flying in an Arctic area was making an IFR approach. Two of his crewmembers spotted a mountain through a momentary break in the overcast. Naturally, they became "shook" and started screaming: "You're going to hit the mountain!"

The pilot, disturbed by the near-panic behavior, involuntarily tightened his bank, lost control and "went in." Only the pilots survived.

Silent Type

Too Busy Type

Feather-head Type

The pilot's opinion was that the accident was caused by the shouting and confusion that existed during his instrument approach. Excitement, confusion and panic all are contagious. A less hysterical warning of the sight of that mountain probably would not have disturbed the pilot. A tragedy might have been averted.

Unless you can contribute advice that will definitely aid the pilot in making the correct decision, "stay off the horn!" If you do get in the ball

"He said, "Get off the brakes." I thought he said, "Get on the brakes."

game, make your suggestions in a calm, easy-going manner.

Accidents resulting from misinterpreted orders are caused by our natural tendency to "short-cut" to save time and labor—to use gestures and fragmentary speech instead of complete instructions.

Gestures are "motions of the body or limbs intended to express an idea . . . to enforce or emphasize an assertion." If effectively used, they replace and/or reinforce the spoken word. Just be sure that Joe interprets your gestures correctly.

When using a word or phrase instead of the complete instruction, be sure that your listener is capable of interpreting correctly your abbreviated version. The basic rule to remember in giving instructions is that the lower the experience level of the listener, the more detailed your instruction should be.

Say Again: "Sergeant Zee told us to prepare to ditch. Some misunderstood . . . they released belts, stood up and prepared to bail out."

When the pilot ditched, there were fatalities among those passengers who thought they were to bail out. Perhaps the "Sarge" had a new plate and didn't enunciate clearly or the passengers may have been panicky and didn't realize what they were doing. In these cases, we don't get the other side of the story.

Signals Over: "When I moved my hand forward for the elevator trim tab, the copilot misinterpreted this as *gear up.*"

Fortunately, however, everybody got out of the burning plane safely.

A little clarification on hand signals before the pilots took off would have prevented this accident. In most accidents of this type, the pilots are "flying strangers" and are not familiar with the other's communication techniques. The wise pilot will make sure that his gestures will not be misinterpreted.

On or Off: "My instructor told me 'to get off the brakes.' I thought he said 'Get on the brakes' . . . the aircraft nosed up."

In an emergency situation, when procedures must be accomplished rapidly, "on" and "off" can sound very similar. In this instance, misunderstanding of a one-syllable word led to a major accident.

An accident in which communications are a factor may never happen to you. Nevertheless, this type of accident has happened to a lot of experienced flying personnel.

Remember, communications to your crewmembers (oral and visual symbols) are intended to bring out one particular response from them. If they "don't read you," you may become a flying safety statistic. When you order or gesture for a particular procedure to be accomplished, you are assuming that the following job components are clearly understood:

What is to be accomplished?
Who is to perform the action?
When is the action to be executed? (Immediately or delayed?)
Where is the action to take place?
How, specifically, is the action to be accomplished?

To an experienced crew, one well coordinated as a team, a word or gesture may convey all of the above components. If flying with an inexperienced or composite crew, however, such an assumption could be very hazardous. You must be certain that your cues, verbal or otherwise, cannot be misinterpreted.

Know the crew you fly with and be sure that you speak the same language. See that everybody "gets the word." Develop the right habits and use them all the time. Don't let a short cut in speech be the short cut to an accident statistic! ▲

Air Crew Coordination

Major Wesley S. Mink, Bomber Branch, D/FSR.

WHAT IS crew coordination and what does it mean if you don't have it in your crew? Remember the old story about the B-29 that lost No. 3 shortly after takeoff?

"Feather three," the aircraft commander shouted, and the copilot obligingly feathered the remaining three.

That's lack of crew coordination. And that's no laughing matter.

Toward the end of World War II a senior Air Force General was fatally injured in a major accident resulting from the fact that a new and inexperienced copilot mistook the general's signal to tighten the throttle friction lock during takeoff roll, for a gear-up signal. The gear was retracted while the aircraft was still firmly on the runway.

This was an accident that need never have happened and one that could have been avoided if the late general had simply briefed his copilot on what to expect from him.

No Briefing

More recently, the similar failure of a B-47 commander to brief his unfamiliar crew, almost resulted in a major accident and in the loss of the aircraft. The crew consisted of an aircraft commander from a staff crew, a copilot from a numbered crew, a staff observer and a crew chief. Although these four crewmembers were well acquainted with one another, and although each was qualified in his respective position in the B-47, this was their first flight together.

After a normal briefing the crew departed, ferrying the B-47 to a northern ZI base for static display. At the end of the two-day display, the crew prepared to leave for home and at this time another briefing was conducted by the aircraft commander. Procedures to be followed in case of emergency, including bailout, crash landing and ditching were covered thoroughly. Takeoff and flight to the home station were normal. The weather was good, 10,000 overcast and seven to 10 miles visibility, in light rain. A normal pattern was flown and touchdown made approximately 1500 feet down a 10,000-foot runway. The aircraft commander attempted to deploy the drag chute but —and this is where the trouble began —the chute failed.

"Well," the commander said casualy over the interphone, "I guess we won't have a chute."

The aircraft commander's feet were still on the floor boards and he had made no attempt to brake because airspeed was still excessive for effective braking. But—about this time the B-47 decelerated momentarily and the main gear tire blew.

"Are you on the brakes?" he asked the copilot.

"Yes," the copilot answered, "I thought I'd help you out."

The aircraft commander advised the copilot to get off the brakes and brought the aircraft to a normal stop, turning off the runway onto the taxiway where he shut down the engines.

The damage to the aircraft consisted only of the blown tire and some minor dents in the nosewheel door and the bottom of the fuselage. But it might have included the whole aircraft, as well as the lives of the crewmembers, for the aircraft commander had not only failed to brief the copilot on procedures to be used in the event of chute failure, he also had failed to brief his unfamiliar crew on the basic fact of crew coordination. He had failed to take into account the dangerous tendency to carry over from one crew to another the habits and attitudes each of them may have developed during flight.

Even more recently an RB-66 crew at a midwestern base nearly met with disaster because of the lack of crew coordination.

Not unfamiliar with one another, this crew had trained and flown together for some time. But they had never faced an emergency together, and returning from a photo reconnaissance mission one day, the aircraft commander entered the traffic pattern and attempted to lower the gear for landing. The gear failed to extend even though all hydraulic pressures indicated normal. He therefore instructed the gunner to enter the crawlway and depress the emergency control over-ride on the landing gear solenoid to lower the gear.

The gunner complied and the gear lowered and locked. At this time the aircraft was on base leg to land. After getting the okay that the gear indicated down and locked, the gunner released the emergency over-ride. The gear retracted. The pilot advised the gunner of this. Still in the crawlway, the gunner depressed the emergency over-ride again and the gear went down again. To make a long story short, the gear cycled from the UP to the DOWN position three times while this aircraft was on final approach and the runway control officer is probably still sick. A safe landing was made only because the last time the gunner depressed the emergency over-ride, he held it down until the aircraft had turned off the runway and the engines were shut down.

What had happened to cause this incident? The pilot's landing gear handle was in the UP position. Except for a persistent gunner with a thorough understanding of the aircraft's hydraulic system, that crew would have had a wheels-up landing.

But if a mechanical failure and the pilot's forgetfulness triggered this emergency, it was something else that made it worse—a lack of crew coordination resulting in unpreparedness to meet the emergency as a practiced team.

These are only a few of a great many incidents and accidents caused by a lack of crew coordination, and perhaps we ought to define these terms more clearly.

Definition

Coordination, the dictionary says, is "an organizing of different parts or groups into a functioning whole." It also is stated as, "the ability to function harmoniously."

A coordinated aircrew is a number of men all functioning together as a single man. In the handling of one of our modern jet bomber or transport aircraft, this is a primary requirement for successful flight.

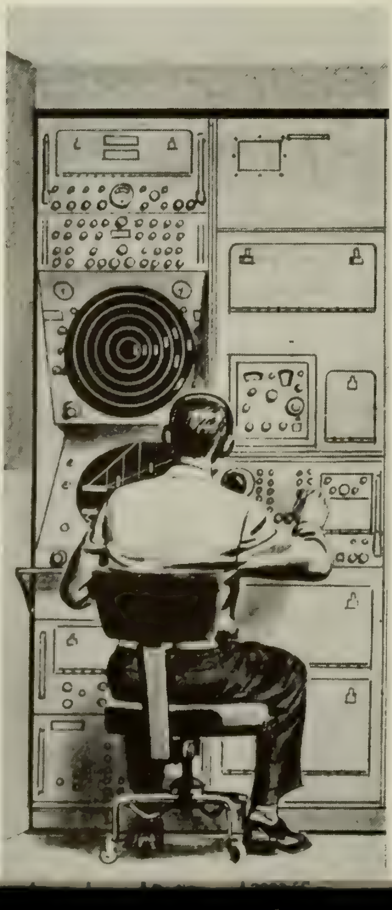
The first problem confronting a newly appointed aircraft commander therefore is the problem of organization around this concept of crew coordination. He must train his crewmembers not only in all phases of their own work but in every aspect of each other's work that touches their own. Thus, in an emergency, each man will know what to expect from all the rest and will understand the problem as it is seen from every point of view. This is by no means a simple thing to do. It requires diplomacy and discipline, understanding and tact. Even with all of this, effective crew coordination comes only after long hours of flying, training and study.

But the net result is worth the effort. In the first emergency you'll either know it's there or wish it was. For, to the air crewmembers, their first real emergency is their graduation exercise. Decisions and action must be rapid and must be right. The well coordinated crew will cope with the situation. The others, unless they're lucky, will fail to meet it and another Form 14 will be included in somebody's file. ▲

"No, I didn't say anything about feathering."

In some aircraft, unless you have good coordination in the use of the interphone, it will resemble a . . .

PARTY LINE



Major David R. Lewis, Cargo Branch, D/FSR.

EACH YEAR an undetermined number of aircraft accidents are caused or induced by cockpit design. While that was not considered the primary cause of the accident in this story, it was an important, contributing item. The real culprit was the interphone system. It wasn't busted either—just doing its normal job, but this time, its normal job wasn't good enough.

As you probably know, the C-124 is a rather large airplane and has a nice spacious cockpit. Because of this spaciousness, however, the crew must rely almost entirely on the interphone for communicating with each other. So, unless you want to yell your head off, you'll use the interphone whenever you fly this bird.

On most aircraft whenever a mike button is depressed to use the interphone, any transmissions to that position are cut out. Also, while the interphone is in use, radio transmissions into the airplane will probably be so garbled that no one will understand them. Consequently, some discretion is necessary when using the interphone in aircraft such as the C-124. Unfortunately, discretion was not used in this instance.

This particular C-124 had been on a flight to North Africa and was arriving back in the ZI when this accident occurred. There were ten persons aboard, six crewmembers up front, and three crewmembers and

In the C-124, somebody talking on the interphone will garble the voice reception from the outside.

one passenger in back. The crewmen had adequate rest prior to commencing the flight, however, they exceeded authorized crew duty at the time of the crash.

Destination of the flight was a southeastern coastal base. Weather forecast for ETA was sky obscured with one mile visibility in ground fog. The alternate, another southern base, was forecast to have 1500 broken, with five miles visibility.

When approximately two hours from destination, a weather advisory was received, stating that upon arrival the visibility would be up to 1½ miles, with 15,000 broken. As the big bird approached its destination, the visibility was reported to be ¼ mile. The pilot entered the holding pattern and contacted operations on the ground for further information. He was informed that visibility was forecast to be at or above minimums in half an hour. He was further advised that two bases, much closer than his planned alternate, were available with clear skies and seven miles visibility. With this in mind, a decision was made to hold, since there would now be no problem in reaching an alternate safely.

As Forecast

The forecaster must have really polished the crystal ball this time, for in half an hour the base was declared at minimums. The report now read 15,000 broken, ½ mile visibility in ground fog, temperature and dewpoint 62 degrees and wind calm.

An airliner holding below the '124 was cleared for an ILS approach and within five minutes was rolling down the runway. The pilot stated that he had seen the approach lights for some distance out and, in fact, had made an almost completely visual approach with little or no reference to flight instruments.

The C-124 had necessary equipment for an ILS approach and the pilot had previously flown an ILS run at this base. Like most pilots in Air Force circles, however, he elected to use GCA for his approach.

As the GCA run progressed, it seemed to be routine in all respects. On final, those words we all love to hear—"on course on glide path"—were coming in loud and clear. About two miles from touchdown, though, the interphone entered the picture and words weren't clear anymore.

The airplane was about 50 feet above minimums when the pilot asked the copilot if he could see anything yet. This was a mistake, for the instant his mike button was depressed, the pilot could no longer hear GCA. The copilot's answer further extended the time that GCA was cut out so the warning that the airplane was now 20 feet below glide path was not heard. What the pilot did hear was "not yet," followed almost immediately by "we're in the trees, pull up!"

The glide slope needle on the ILS indicator was deflected full up during this part of the final approach. This went unheeded by the pilot. In addition, the APS 42, which could have been used for monitoring the approach, was idle. At the last two stops, it had been used to monitor the approach but this time the navigator had "closed out" for a bit of sack time as soon as landfall was made.

When the copilot shouted the warning to pull up, the pilot glanced up momentarily and saw the trees. Simultaneously, he was calling for maximum power, shoving throttles forward and pulling the wheel back. He was just a bit late though, for as the power took hold and descent stopped, they hit the trees. Immediately, thereafter, No. 3 engine failed.

Airborne

As the plane struggled out of the trees, the pilot ordered gear and flaps up. Flaps were retracted first because the pilot suspected hydraulic troubles and believed that if the gear was retracted first, he possibly wouldn't be able to bring up the flaps. His logic in even bothering the flaps may be questionable since he only had 20 degrees down, but he was correct in suspecting hydraulic troubles. The exposed hydraulic lines on the main gear had been damaged so one gear only came part way up and the other wouldn't budge.

No ADI

When the engineer increased power, he neglected to turn on the ADI. Then, because of a misconception which he had as to the results of turning ADI on with engines at full power, he decided to leave it off. To further reduce avialable power, the oil coolers had been rendered inoperative. So, oil temperature on all three remaining engines was right up against the peg. With the dragging gear and only three engines, which were putting out considerably less than maximum power, the '124 was barely able to attain a thousand feet.

Immediately after the collision and during at least part of the climb, there was an understandable period of time when all hands were busy. Further, because of the size of the beast, a lot of interphone conversation was necessary during this period. This use of the interphone, plus a few rapid channel changes, prevented the GCA controller from effectively giving instructions to the pilot. When contact was finally re-established, the airplane was no longer on the GCA scopes so the pilot was instructed to re-home on the outer marker.

Missing Antenna

This created another problem. The collision had removed most of the antenna from the belly of the airplane. This was unknown to the copilot, however, so he tuned in the outer marker to one compass and the middle marker to the other. A comparison of the bearings shown on the two compasses indicated that something wasn't quite right and a little experimentation revealed the difficulty. An attempt was then made to obtain a loop bearing, but about this time GCA was on the horn again. They had a target on the scope and wanted identifying turns made. After staggering through a couple of turns, which didn't help the altitude any, they were informed that the target was apparently another plane.

About that time the pilot remembered that the OMNI antenna was back in the tail section of the plane and probably wasn't damaged. The local OMNI frequency was set up and from all indications, the set was okay. An inbound track was promptly assumed and in a short while GCA had the airplane in positive radar contact.

Approximately 35 minutes had now passed since the trees got in the way on the first approach. Number 4 engine was cutting out frequently and No. 1 was losing power. An abortive attempt to reduce power to lower the oil temperature had only resulted in loss of altitude. The big bird was now struggling along at 500 feet and was straining to hold that. The engineer had been instructed to keep all engines running as long as possible but now he warned the pilot that No. 4 couldn't last much longer.

The inbound heading to the OMNI station placed the '124 on a dogleg to the final approach. The turn to final heading was a little short, so corrections were given which returned the airplane to track. Course was maintained then until about three miles out, when the plane drifted off to the right of the center line.

The azimuth corrections given were in a "no-gyro" fashion. The GCA operator had apparently misunderstood previous transmissions concerning radio compass failure and believed the directional type compasses were out. The copilot made an attempt to correct the situation but was unsuccessful, since the controller's mike was keyed continuously.

On this approach the airplane was down to 500 feet and still losing altitude when the final controller took over. When the airplane drifted off at the three-mile point, azimuth corrections were given to the left until about one mile out, when the bird was back on track again. The final controller was giving a last correction to the right which should have lined the airplane up with the runway—when the flight engineer came out with the news that he'd just feathered No. 4.

There goes that interphone again! And once again the pilot missed a GCA transmission at a critical point of the final approach.

Just then a string of lights appeared dimly through the fog. Instictively, the pilot headed for it but the copilot told him that the lights were from vehicles on the highway and that the runway was off to the right. It was too late to make the runway but in order to avoid the highway, a hard, right turn was necessary. During this turn, the right wingtip struck the ground—and then the farm was really bought! They crashed inside the airfield boundary. The C-124 was destroyed and three of the four people in the cargo compartment were killed. Miraculously, all crewmembers up front lived.

GCA Checked

An AACS maintenance and flight check of the GCA unit involved in this accident, revealed no discrepancies that could have caused this accident. The GCA operators were well qualified. Informal test runs by C-124 aircraft revealed later that no matter what portion of the target blip was used as center point, the aircraft should still have had adequate terrain clearance.

A prominent contributing factor was use of the interphone during the GCA run. You may recall that on three occasions the interphone blocked out ground transmissions that possibly could have "saved the day." What's your verdict? It is very clear that some modification of the C-124 interphone system is necessary, for there comes a time in every birdman's life when he has the urge to talk and listen at the same time.

It is too late now to keep this accident off the books but we can use the lessons learned here to prevent future accidents. Be sure that you know your airplane and its limitations, and don't let it get you into a similar situation. You may not be around to explain what happened—as this crew is, fortunately. An added thought is to also know your crewmembers and their limitations. Be sure that they are trained in such basic items as *when or when not* to use the interphone. ▲

Cockpit Daze

Maj. Raymond W. Staudte, HEDCTAF, Randolph AFB.

WHAT CAUSES an aircraft accident, when both the aircraft and the pilot appear to be in perfect working order? Even more important . . . "What can we do about it?"

An aircraft flies into one end of a cloud and fails to come out the other side. A pilot flying under instrument or night conditions suddenly finds himself rolling over on his back. Or, on a clear, bright day, a pilot dives into a ground gunnery target, apparently making no effort to pull out.

Sometimes the reason is—and it can be a dangerous one—FASCINATION! It might be called by other names: Cockpit hypnosis, fixation or even "asleep-on-the-job." There are two important factors involved:

- You may have been looking at the wrong instrument at the wrong time. You may have taken a reading from the radio compass indicator instead of from the slaved gyro. You may have had your head in the cockpit when you should have been scanning the horizon.
- The second factor—and just as important—is that of looking at the right object but taking the wrong action or no action at all. Such a case might be an improper or inadequate instrument cross-check. It might be just plain "asleep-at-the-switch." We are sometimes so intent on doing a bang-up job that we find ourselves concentrating on many things at the same time. Occasionally, we leave out the very thing necessary for perfection or safety. We might find ourselves flying a perfect heading and rate of descent on a GCA, but our airspeed has fallen off and . . . here come the crash crew!

Why does fascination or fixation, or cockpit hypnosis, take place? In order to operate efficiently we must be able to focus our attention where it is needed and when it is needed. We must "take in all the sights" and use only those that are necessary to accomplish the job at hand. What causes a pilot to become hypnotized by a particular instrument, target or light? Why does he become "stare crazy?"

As we take a look around, it's natural to take in first the sights which catch the eye—like colors, contrast, movement or simply those things which are the least difficult to distinguish.

Many sights compete for our attention at the same time. Which one should we pick? As we gain experience, we learn to pick out those which will do us the most good at the time, depending on what we're trying to do. It's a cinch we can never use all that nature throws our way. Only through training and experience can we become proficient in using up those resources properly. To put it bluntly, we've got to pay attention to what we're doing.

Pilots who fly around in a daze are looking for trouble, and, unfortunately, other people sometimes get hurt.

Day dreaming uses up precious moments which should be devoted to something more important. A long delay in cross-checking instruments can result in disorientation such as getting off course, altitude, airspeed or attitude. Failure to scan the skies frequently might result in a mid-air collision. That second or two devoted to fascination robs us of a second or two which we could use for decisions or reaction time.

The drone of the engines or a monotonous radio signal tends to hypnotize us, particularly on long, straight-and-level flights. Things happen so slowly that we are unable to operate properly. The interest lags when we're not busy doing things. This is the cause of many automobile accidents on long, straight highways when drivers fall asleep at the wheel and run into the car ahead.

At night, flashing or rotating lights might sidetrack our senses. Can we afford to have our attention diverted while on final approach for landing?

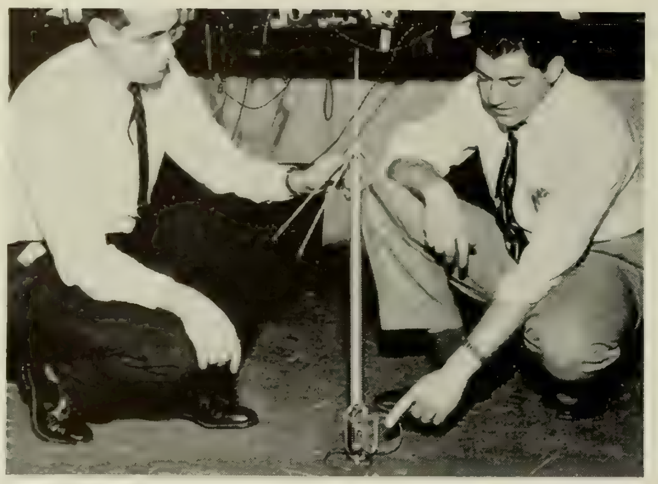
Now that we know what the problem is, how are we going to solve it? Records show it to be more evident among the very inexperienced pilots. The answer then must be in training and in the development of habits. Are we building the right habits?

Attentiveness is something that has to be learned. Try explaining nuclear fission to a four-year-old and you'll notice that he loses interest immediately because it means nothing to him. As we fly more and more, we learn that our time must be divided, so much to inside the cockpit and so much to the outdoors.

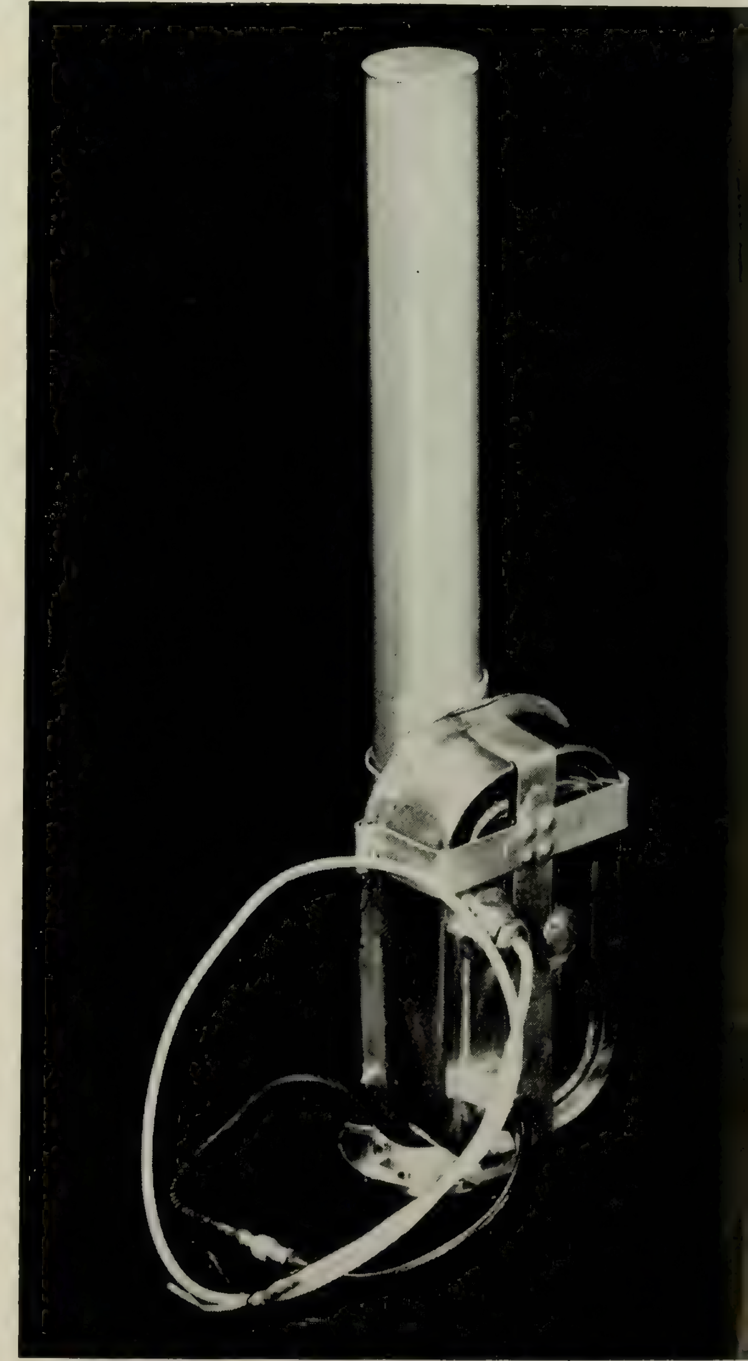
But let's not permit experience to go to our heads. The minute we do that, we relax and become a perfect target for hypnosis or fixation. The natural reaction is to duck when you're a target for something unpleasant or dangerous. There is no way to duck this problem. You have to lick it. To quote some over-used but still up-to-date advice: "Stay Awake and Stay Alive." ▲

Keep Kurrent

NEWS AND VIEWS

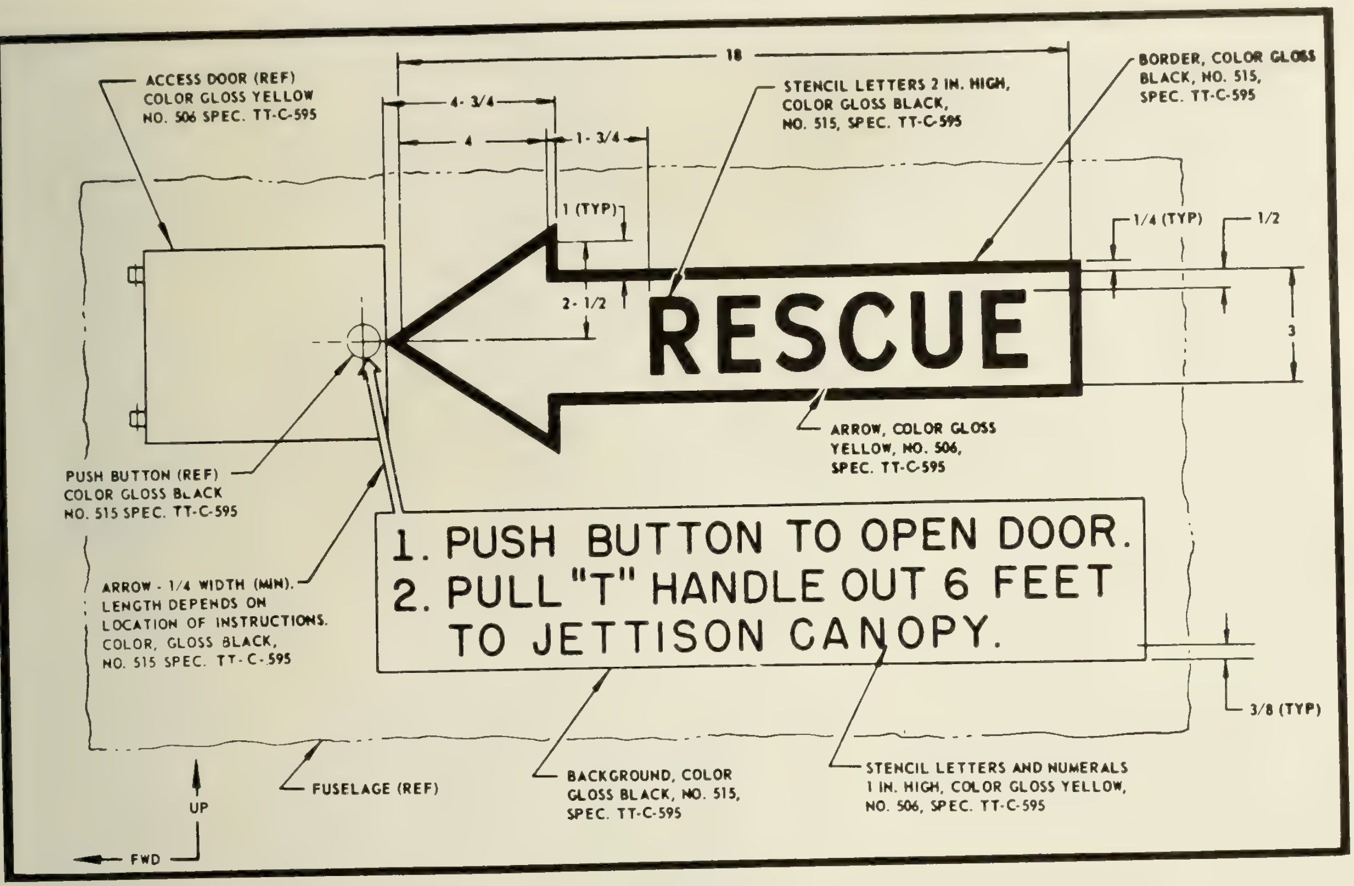


Sardine Can—A UHF Beacon Transmitter that fits into a standard size sardine can and a 12-inch tube that explodes into an antenna has been developed by Fairchild. Designed as an emergency signalling and communications device, the "sardine can" can be modified for voice or code. The transmitter weighs in at eight ounces and the hermetically-sealed tube is exploded into action by a gun powder charge.



Above, is pictured the new, two-seat F-101B interceptor. It is one of three types of the Voodoo series designed for the Air Force.

Below, is the Lockheed C-130 taking off from a snow-covered, northern lake. With this ski-and-wheel version, versatility is the keynote.



Pictured above is an actual reproduction of the markings as prescribed by the Technical Order.

The '86 touched down in a slightly tail-low attitude, skidded several hundred yards and came to rest at about a 45-degree angle from the flight path.

Jim was dazed when the fighter finally stopped but he noticed that the canopy was still on the airplane. The jettison handle was up and he pulled on it again. Still nothing happened.

He turned on the battery switch and tried to raise it electrically but the canopy wouldn't move. Jim reached for the manual release and jerked on it. It refused to budge.

Seeing fire along the trailing edge of the flaps, Jim suddenly got that helpless feeling of being trapped. He turned off the battery switch, took off his chute and harness, stood up in the seat and pushed against the canopy with his back. The canopy resisted like a stone wall.

Smoke had now filled the cockpit and Jim had difficulty breathing. He hurriedly put his helmet and mask back on and switched the regulator to 100 per cent oxygen. The oxygen pressure gage read zero!

To get the pilot out, a by-stander busted the canopy with a camera.

Captain Jim Flytype became desperate. Rather than burn to death, he decided that he would attempt to eject himself through the canopy. He strapped himself back into the seat as fast as he could; fastened the chin strap of his helmet, tightened his belt and harness, put his feet in the stirrups, and squeezed the trigger. Nothing happened! (He didn't know that this bird had not been modified and was one of the series where the canopy must go before the seat will fire.)

Fortunately for Jim, his crash landing was seen by a pilot flying a trainer in the local area with a cameraman who was taking movies. When the pilot circled the '86 at low altitude, he could see Jim in the cockpit—the canopy still on and fire starting aft of the wings. He made a wheels-down landing near the crashed plane, and, using the 30-pound camera as a mallet, beat a hole in the canopy large enough for Jim to crawl through.

Within a few minutes, fire consumed the aircraft.

This may read like the plot of an old movie on a late hour TV program, but it is a true story and it happened in 1956.

The files of accident records contain reports where the pilot was not so lucky. The reports which are most disheartening are those about a pilot or a crewmember who lost his life because persons on the ground did not know how to use the external emergency release.

Being burned to death is not a pleasant thought. Probably this is one of the greatest fears of all animals (including human). Legends tell us that all animals are inherently afraid of fire.

National disasters have occurred when large numbers of people were trapped in theaters, night clubs, circus tents and hotels. The aircraft presents a greater hazard than do most structures, for it is normally loaded with large quantities of highly volatile fuel.

Aircraft designers have gone to great extremes to provide emergency exits and devices for getting people out of disabled airplanes. It is up to us to know the use of this equipment.

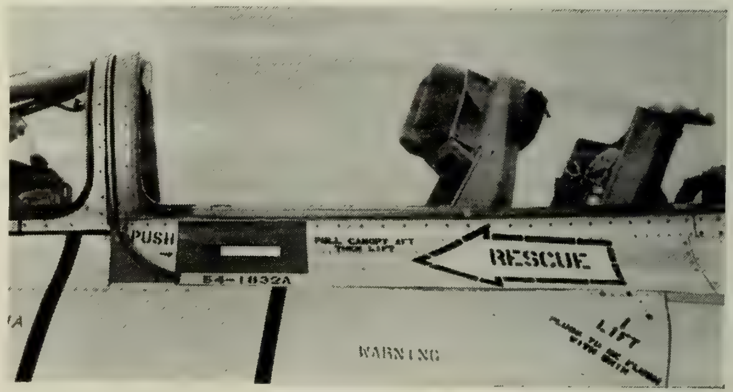
Normally, crewmembers are fairly familiar with emergency exit procedures for aircraft operated at their own base. But, how about the latest series transient aircraft? If an F-104 or an F-101 made an emergency landing at your base and was burning, and you were the first person to arrive at the scene, would you know how to blow the canopy? If you were the pilot of that burning aircraft, you would certainly *hope* that *somebody* knew how to remove the canopy, if you couldn't jettison it yourself.

In this connection, T. O. 1-1-636, Paragraph 3-86, dated 1 November 1956, contains important information to help ground crews locate the external canopy release. It lists the specifications for painting a large yellow arrow, pointing to the canopy release actuator. Yellow letters (one inch in size), explaining *how* to operate the system, are painted on a black background.

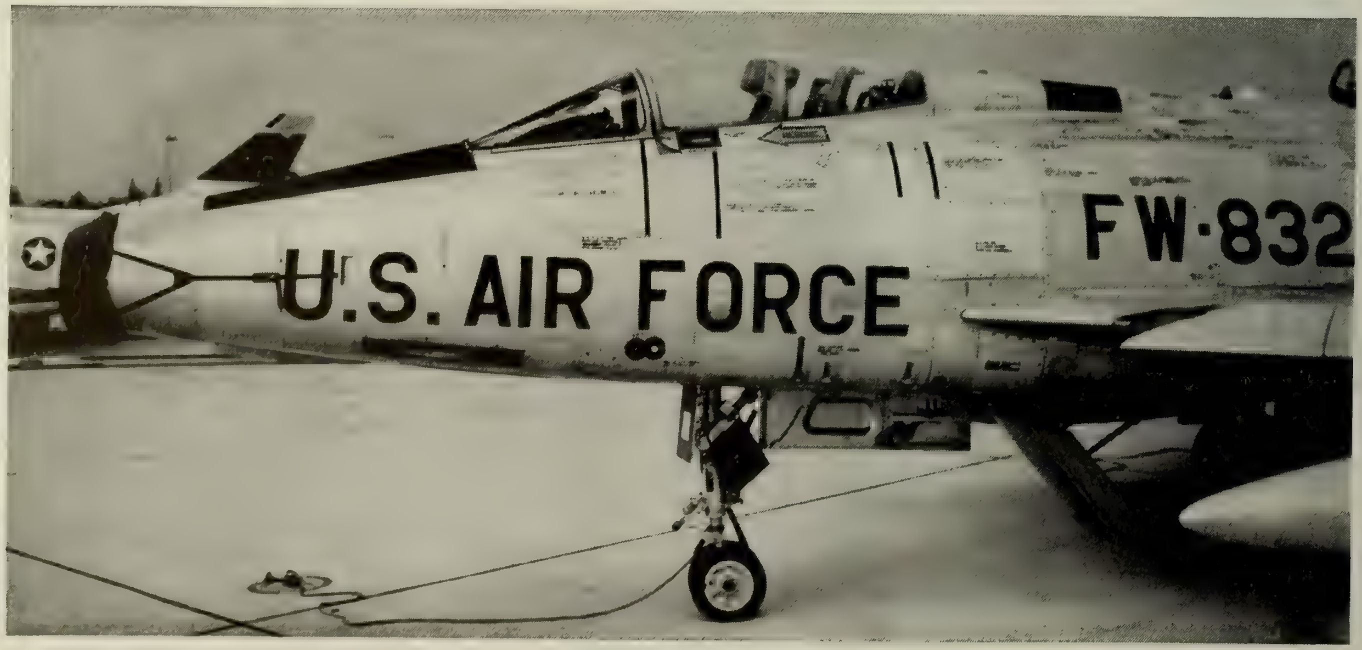
You can do much toward making the Flying Safety Program effective by seeing that this tech order is complied with on your base.

Operations might schedule frequent briefings of crash crew and maintenance personnel, crewmembers, air police and others working near the flight line. Each should know *what* to look for and *how* to use the canopy external release mechanism, in the event they are the first to arrive at the accident scene. One of the points often missed or misunderstood is that the external system is not a trigger action. The lanyard must be pulled and held—for 10 or 15 seconds. Give it time to work. It may seem like a long time.

Base Flying Safety Officers can boost the program by inviting representatives of local community organizations (such as the fire, police and sheriff departments and the State Highway Patrol), to participate in a discussion about the use of this mechanism. Here, again, be sure that you explain explicity *what* to look for and *how* to use it. ▲

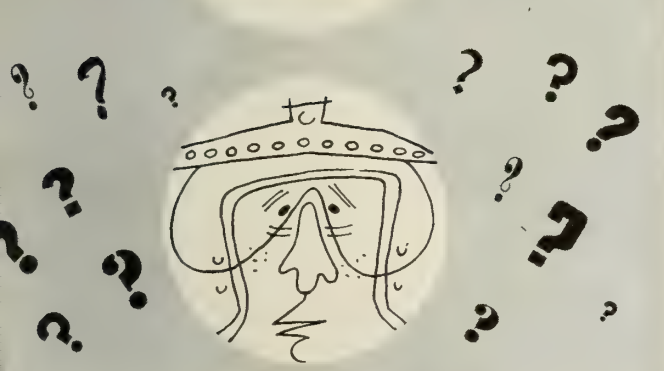


Shown here are two shots of the external release markings on the F-100A.



How Well Can You Remember?

If you miss more than four
you had better check
those back issues.



April (Flight Planning)

1. The letter "L" attached to a compulsory reporting point symbol in the Radio Facility Chart indicates a position report must be made only if you are flying below:
   (a) 15,200 feet.
   (b) 17,000 feet.
   (c) 29,000 feet.
2. When holding below 19,000 feet you are expected to hold at a true airspeed not to exceed:
   (a) 155 knots.
   (b) 180 knots.
   (c) 200 knots.
3. Contrails disappear when the tropopause is penetrated.
   (a) True.
   (b) False.
4. The heavy black line on the facsimile constant pressure chart is made for any wind velocity in excess of:
   (a) 50 knots.
   (b) 75 knots.
   (c) 80 knots.
5. The jet stream shifts:
   (a) Southward in winter.
   (b) Southward in summer.
6. With TACAN when you are directly over the station, the distance measuring indicator:
   (a) Will read Zero.
   (b) Will be inoperative.
   (c) Depends on altitude.

May (The Emergency)

7. A 15,000-pound T-Bird will glide as far as an empty one.
   (a) True.
   (b) False.
8. With a closing speed of 600 mph, head-on, with the approaching aircraft at 1.16 miles, you would have ....seconds warning, if you were looking straight ahead.
   (a) Five.
   (b) Seven.
   (c) Nine.
9. You are equipped with an automatic parachute and lap belt. The parachute will open automatically only if:
   (a) You open the lap belt manually.
   (b) Eject below 2000 feet.
   (c) Let the lap belt open automatically.
10. The F-1B timing device is set to open the parachute in ....
    (a) One second.
    (b) Two seconds.
    (c) Three seconds.
11. With the MA-5 and 6 automatic lap belt, it is impossible to close the belt without using the key.
    (a) True.
    (b) False.
12. On a GCA, the rate of descent varies with wind direction and velocity.
    (a) True.
    (b) False.

June (The Crew Station)

13. On some of the late model T-33s a safety pin for the external canopy jettison mechanism is located:
    (a) Above the right console, front cockpit.
    (b) Above the right console, rear cockpit.
    (c) None installed.
14. The latest instrument (Max-Min airspeed indicator) developed for use during the approach, also can be used during climb and cruise, and is based on measuring:
    (a) Lift over the wing.
    (b) Airspeed.
    (c) Angle of attack.
15. In a C-124, when a crewmember uses the interphone system, radio reception from outside is:
    (a) Not affected.
    (b) Completely eliminated.
    (c) Garbled.
16. The outside location of the external canopy jettison mechanism is marked by:
    (a) A large red arrow.
    (b) A large black arrow.
    (c) A large yellow arrow.

ANSWERS

1. (a)	5. (a)	9. (c)	13. (b)
2. (a)	6. (c)	10. (a)	14. (c)
3. (a)	7. (a)	11. (b)	15. (c)
4. (a)	8. (b)	12. (a)	16. (c)

REX SAYS

THE TOWER cleared me into takeoff position for a local flight in an F-86F. I advanced the throttle and allowed the RPM to stabilize at 80 per cent. I then placed the emergency fuel switch in the ON position and advanced the throttle. The RPM hung at 84 per cent, then I heard a slight rumble. The RPM dropped and the tailpipe temperature went to 1000 degrees. I immediately stop-cocked the throttle, turned off all switches and evacuated the aircraft. The Fire Department put out the fire.

A check of the engine showed that the turbine buckets and nozzle diaphragm were subjected to extreme heat. The fuselage was burned through just aft of the turbine wheel.

REX SAYS*—So now you know about compressor stalls. Sometimes—as in this case—it helps to retard the throttle instead of advancing it. The clue is when it balks.*

RETURNING from a mission in an '86F, I was approaching the base from the southwest at 12,000 feet when a very definite power loss occurred. Throttle movement had no effect on RPM and tailpipe temp read 250 degrees. I thought I had a flameout and stopcocked the throttle. At 10,000 feet, 22 per cent rpm and 190 kts, an airstart was accomplished. The tailpipe temp, however, wouldn't go above 250 degrees and the RPM wouldn't go above 22 per cent. Since I was in good position to make a flameout landing on the base, I stopcocked the throttle, advised the tower of my intentions and landed without further mishap.

I'll have to admit that my face was somewhat red when they told me later that my trouble was due to the main fuel control failure. They checked the emergency control and it was okay. I could have saved some gray hairs if I had just throttled back, switched to Emergency, and gone back into business.

REX SAYS*—You darned near made the team—the team that keeps pranging because they won't use the equipment they've got. This sounds something like the catcher dropping the ball on the third strike—! Your first strike: not using the emergency system. Your second: Stopcocking an engine that was doing something for you in preference to nothing at all. Your third: an unnecessary flame out landing. Head for the showers—but thanks for passing it on.*

★ ★ ★

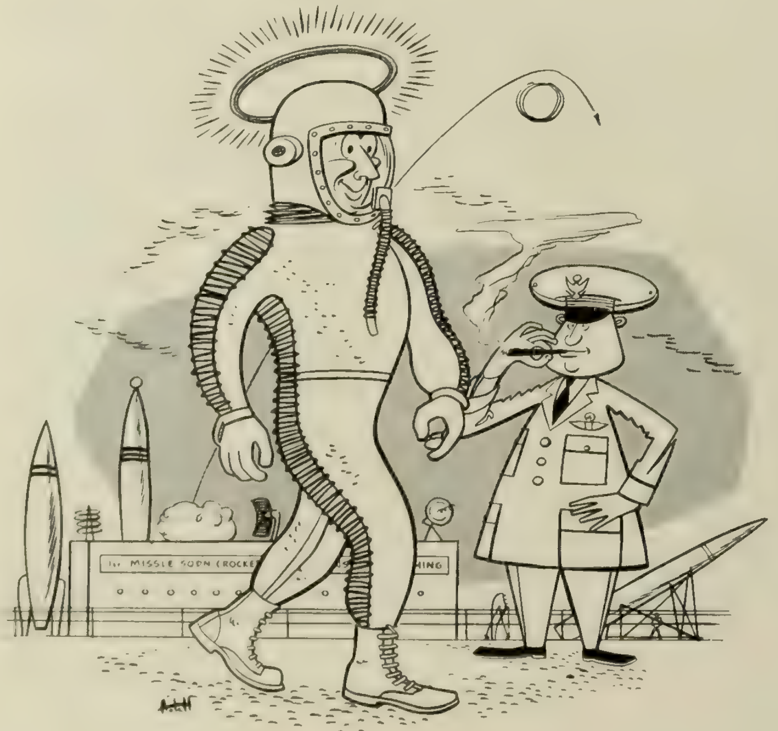
ON BASE LEG gear check, the left main indicator remained in the unsafe position and the light in the gear lever remained on.

I called mobile to check my gear on a low pass. They said it appeared to be down and locked, but the gear doors were still open. Mobile told me to stay in closed pattern and pull the emergency gear lanyard on downwind.

I raised the wheels, flaps and speed brakes and made my pattern. The utility pressure was checked okay. On downwind the speed brakes, flaps and gear were put down. The left main still remained unsafe. Emergency lanyard was pulled completely out and the gear still indicated unsafe. The aircraft was yawed with no results.

I was advised to come in because the gear appeared down and locked. Final was hot in case the gear was not locked. Upon touchdown the left wheel folded. I applied full power, picked up the left wing and then the gear indicated safe. I leveled out and landed without further difficulty.

Been out of this world, Gridley?



***REX SAYS**—Good thinking. Bouncing's okay—but keep it hot till you know the gear is going to stay.*

★ ★ ★

WE WERE ON an initial F-100 checkout mission. We got our clearance to roll, and turned 'em loose. Just as we were hitting 120 knots (in afterburner), a tug chugs onto the runway towing an 86H. He was dead ahead of us, and too close for us to leap. When he saw us coming, he increased his speed trying to beat us across. It was too late to abort, and that tug doesn't have jato. And they talk about race drivers.

Luckily, my student had enough room to go around without running off the runway. Had I continued down my side of the runway, I would have met the '86 broadside. I fell in trail with my student and took off about 30 degrees off the runway heading to avoid jet wash.

***REX SAYS**—It's enough trouble trying to keep debris such as nuts and bolts out of jet intakes, let alone tugs and '86Hs. You did an excellent job in missing the tug and airplane. Your base could stand to look at its airdrome traffic control procedures. Whatever happened to the light from the tower arrangement?*

★ ★ ★

HERE IS a real way to get valuable cockpit time.

Take three pieces of paper and on one, make a sketch of every switch, gage, lever, lanyard, light, button and knob that you can find on the left panel, and label them "on-off," "up-down," and so on. If you can find a cockpit with the seat removed, it will give a better view of the rear panels.

Do the same with the front panel on the second sheet of paper, and the right side with the third. You need not be an artist, but do the very best you can so as to give fidelity to proportion and placement. It may seem like a big job, with a lot of gizmos to draw, but as you will find out, it doesn't take long. Once the drawings are completed, you will be amazed at how much you have learned about the cockpit interior.

***REX SAYS**—The above was suggested by the aggressive Flying Safety Officer of England AFB, Louisiana. Like he says, you will be amazed at how much you learn.*

REX SPECIALS

A RECENT accident report stated that the pilot was unable to operate the night flare end of the distress signal, Mark 13, Mod 0. Since this is a signal designed to be used in time of emergency, malfunction thereof could greatly reduce a pilot's chances of being rescued. Here is a description of this vital equipment.

Signal, Mark 13, Mod 0, is a combination distress signal for use under day or night conditions. It can be carried conveniently in pockets of life vests, flight suits, life rafts or other survival equipment. It is particularly adapted for use by crewmembers downed at sea.

The signal contains an orange smoke canister in one end and a pyrotechnic flare pellet in the other. Both ends of the metal tube are closed by a soldered cap to which is attached a pull ring.

Upon removal of the soldered closing cap, a brass wire attached to the bottom is pulled through a small cup coated with a friction-igniting composition. This action results in igniting the pyrotechnic flare or the smoke composition, depending on which pull wire is removed.

Smoke emission time is approximately 18 seconds; flare burning time is 18 to 20 seconds. The soldered cap on both ends of the signal is covered with a paper cap to prevent accidental ignition. Also, each end of the signal is waterproofed and insulated against transfer of heat from one section to the other.

Use of the flare is simple. It consists merely of deciding which type of operation you want (smoke or flare) and pulling the ring. If this is too difficult to remember, there are pictures on the case, and you can't go wrong. One thing that some have found a spot tricky is the matter of deciding which end the flare is in. That one is simple too. It's under the dots. For the engineer in the crowd, the flare end can be identified by a series of embossed projections extending around the case approximately one-fourth of an inch below the closure. Now for a couple of "Don'ts":

- Don't aim the thing at your head. Hold it up and out. You want someone else to see the thing. And,
- Don't (to get overly simple) light both ends at the same time. Besides burning your eager little hand, only one end is good at a time: the smoke by day, the flare by night. It's the only time that either can be seen.

★ ★ ★

SEVERAL Operational Hazard Reports about ammunition links jamming the aileron controls in the F-86H are on file. In one instance, the stick locked several inches left of center. The pilot could move the stick to the left but each time it would jam in the same off-center position. Another report indicated that the ammo link chute for the upper left gun had fallen down, and 49 of the 50 links remained in the left gun bay.

***REX SAYS**—This is certainly an accident potential. Armament personnel, Maintenance crews and pilots should take a close look at this item to insure that an airplane is not lost due to ammunition or links jamming the aileron push rod.*

Rex Says:

I WAS FLYING an F-86D. Starting a penetration from 20,000 feet, I noticed I had no speed brakes nor utility hydraulic pressure. When I reached traffic altitude, I slowed to 170 kts and lowered the gear. The main gear showed down and locked, but the nose gear indicated unsafe.

I reached for the emergency gear handle and pulled. The canopy immediately left the aircraft and I realized what I had done. The canopy lock handle is located slightly to the right of the emergency gear handle. One is a T-handle—other a hook.

REX SAYS*—The lessons come hard sometimes. You've got to think, then look, then do. Don't trust to feel unless you have no other choice.*

★ ★ ★

I CALLED gear down on base leg but I didn't check my selsyn indicators as I was concentrating on not overshooting my final turn. I did not hear Mobile Control tell me to go around. However, I did see two red flares and started a go-around immediately. As I opened the throttle, I saw that the indicators showed my gear to be up.

The '86 settled momentarily and I felt the drop tanks scraping the runway. My airspeed was 140 knots at this time. I continued the go-around and landed without further difficulty.

REX SAYS*—You were luckier than most pilots. During 1956, there were 251 USAF gear-up landings. Sixty-five of these were nearly identical to your case. The pilots called the gear down and locked, but they either did not put them down or didn't check them down.*

There were 251 gear-up landings during 1956.

dream about Flying-BUT DON'T....
FLY ABOUT DREAMING!

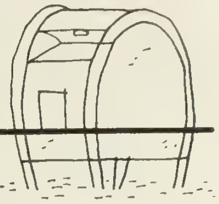
REX SPECIALS

I WAS NUMBER TWO in a flight of four F-89s approaching the base for a landing. My transmitter was out; however, I was receiving five by five. Just as I flared, the tower told me to take it around. As I pulled up and started to raise the gear, I noticed that the gear handle was already up. My next attempt was a normal gear-down landing. Thanks to an alert tower operator, I was saved from a head-up, gear-up landing.

REX SAYS*—Kudos to the glass-box-boys. Your story is similar to many I've heard. The GCA troops are right in there too. Shows what can happen when everybody gets into the act: YOU CAN PREVENT ACCIDENTS. If the tower is screaming so loud, you can't hear your warning horn, listen to that boy. He's trying to tell you something.*

CROSS FEED

LETTERS TO THE EDITOR



Tiger Training

As a reader of FLYING SAFETY over the years, I would like to commend your very excellent product. The article entitled "Bail Out" in the February issue by Captain Harry Tyndale is particularly good. In addition to being readable and informative, it focuses on mental attitude and psychological conditioning — fundamental but often overlooked factors in aircraft accidents and incidents.

With reference to the article, "The Big Picture," in the same issue, I would like to take exception to the thinking exemplified by this statement: "Training must be directed toward the pilot of lowest proficiency rather than to the pilot of average or superior ability." Such a course of action can only produce a substandard fighter force. The payoff in air combat is to the winner. There is no second-place money. There must be a better approach.

A comparison of statistics in "The Big Picture" and those in the article, "Down and Locked" (also in the same issue), suggests that we may be asking too much of younger, less-experienced pilots; however, there may be an erroneous bias in that the newheads carry the load of the difficult, single-place, all-weather interceptions. The facts do indicate that the first few hundred hours of jet-fighter experience is the hump to get over.

Captain Tyndale's article suggests an area of profitable digging. Accelerate the Blue Flame program and let more of the old-brown-shoe Air Force earn their pay on the alert line rather than in the Gooney Birds and Baker—'scuse me—Bravo two fives. Phase the newheads in as they demonstrate capability.

Colonel Harry B. Allen
Chief, Tactics & Techniques Div.
Hq CADC, Ent AFB, Colorado

The policy of concentrating on the pilot of lowest proficiency is based on the theory that a flight, for example, is no stronger than its weakest member and that no combat capability is sacrificed by bringing the weakest man up to par. Thanks for your interesting observations. Anyone else care to comment?

Flying Safety on the Airways

I've just read "Flying Safety on the Airways," in the April issue and believe the article is excellent and one that definitely should not only be read by all but also should be incorporated into a booklet or manual on instrument flying procedures.

. . . From nearly four years in Flight Service there are points which I believe pilots tend to misunderstand. For example, in the past three months we have averaged about two or three near-miss reports per week.

To cite one instance, a commercial airliner cruising northbound on Victor 137 IFR and clearing at 14,000 feet, reported a near-miss of 25 feet with three jet aircraft over Palmdale proceeding southbound at 14,000 feet. This airliner was on an IFR hard altitude, 14,000 in the clear. The jets evidently were flying Victor 137 following the prescribed even altitude for a southbound heading. In my opinion, the only true protection airways offer for separation is when actual instrument conditions prevail all the way up as high as airplanes can fly and therefore all traffic is controlled. Because many pilots believe that an assigned altitude IFR airways gives them proprietary rights and protection at that altitude, it is my personal belief that they, the pilots, are not as alert to the dangers of collision as they should be. It is also my personal opinion that there is too little knowledge by military pilots of the operation of civil aircraft, particularly commercial airlines. As you know, military regulations always comply with the CAR and in most instances are more stringent and actually afford greater safety factors.

It is common practice, based upon reports from the CAA Aeronautical Center, Will Rogers Field, Oklahoma, for airliners to climb through an overcast, get on top and cancel their IFR clearance. This is perfectly legal under CAR. Air Force pilots may not fly over even a broken cloud deck on VFR clearance.

I also believe there is a great misunderstanding among military pilots as to the correct procedures for proceeding to an alternate and that the alternate as listed on the DD 175 is not copied by an ARTC Center and therefore not forwarded by the original center to the center of destination.

These comments are merely personal observations on points which I feel that the lax pilot does not fully understand. I think your article is accurate, concise and really needed.

Lt. Col. Harry N. Young
1229th AACS Sq (Flt. Svc)
Hamilton AFB, Calif.

Plans are in the mill to reproduce "Flying Safety on the Airways" under separate cover. Thank you for your comments on the subject. Here's hoping the article corrects some of the common errors committed.

Do-it-Yourself

As FSO for the 49th Fighter Bomber Wing, I felt the distinct need for a new and better flight safety bulletin board to replace the old "eye sore" in our base ops. I attempted to requisition a USAF type but found out it was no longer an item of issue, so decided to design one myself and have the Installations Engineer build it. The enclosed picture and plan are results of my efforts.

As designed, it will serve three purposes: (1) a flight safety and statistics bulletin board; (2) a magazine rack for other flight safety literature, and

(3) an attractive and interesting board that warmly welcomes flight crews on their arrival to base ops. Confidential information or statistics can be omitted by placing a card marked "Conf" in that slot.

This flight safety bulletin board in our base ops has attracted quite a bit of attention. I've had calls from FSOs at other bases asking for a copy of the plans. Probably they have had the same problem. I should like to offer the plans to anyone who wants to build this board. I feel that by publishing the picture and an item in FLYING SAFETY, anyone interested could write to the FSO, Misawa Air Base, APO 919 San Francisco, and I would gladly send them a copy of the plan. The only change necessary would be the wing and base designations.

I hope to hear from you soon.

Capt. Joseph F. Sanchez Jr
FSO, 49th F-B Wg.

One of the finest boards we've seen. Since receipt of this letter, Capt. Sanchez has been returned to the ZI. Perhaps the boys at Misawa can still answer questions concerning the bulletin board.

WELCOME TO MISAWA AIR BASE
THE STATE SIDE BASE
HOME OF THE FRIENDLY 49th FBW
FLIGHT SAFETY BULLETIN BOARD

More Margin

Your excellent publication is so much in demand at this base that it is extremely difficult to keep reference copies on hand for more than a few days after it is received.

To alleviate this situation and to set up a reference library containing all publications for the year, we have been putting several issues aside for binding and display in our magazine and PIF file in base ops, and here is where the trouble starts.

The holes that we punch in Flying Safety Magazine need to be set so close to the edge that the paper soon tears and we lose the book. And if we set the holes in farther from the edge, we lose a portion of the article and, worse yet, the reader's interest, since he has to pry the pages apart to get at the printed material.

Please . . . give us about 7/16" more margin to work with in binding . . . or, how about publishing the book with holes already punched?

Capt. Cornelius J. Klapthor
Asst Base Ops Officer
Hq 824th AB Gp, Carswell AFB.

Sorry, no can do. The established criterion for printing prohibits it. How about checking with your Librarian as to the possibility of binding the issues in book form?

Survival Training

Last February there were two accidents near this base which required the immediate use of survival equipment. Unfortunately, one pilot neglected to wear his exposure suit, was forced to bail out, landed in water of 32°F, and died from over-exposure. The other pilot was wearing his exposure suit but did not remember how to inflate the life raft. This, plus the fact that he could not swim, caused him to panic. Fortunately, however, a fishing boat picked him up shortly after he landed in the water. This pilot was an "old head" at the game but had not been re-briefed on the use of survival equipment.

These two accidents brought up the question, "Why the laxness in knowledge of survival equipment?" In a survey to find the answer it was discovered that 40 per cent of the pilots at this base were not sure how to inflate the life raft. Since most of our flying in this area is over water, this was a shocking discovery. The answer, of course, is the need for survival training for all pilots.

During the survey mentioned above, several interesting articles were found in past editions of your magazine on the proper use of personal equipment and survival information. However, in view of the incidents mentioned herein, the need for more articles on the subject of survival is evident. Much is being said about flying safety but survival seems to be forgotten by many.

Maj. W. H. Moore
Asst. for Safety, 39th ADiv
APO 919 San Francisco

'Tis shocking, all right, to read about that 40 per cent figure! A future issue of FLYING SAFETY will carry an article about the proper use of survival equipment.

Single Engine

The flight handbook on the RB-57 quotes a safe single engine speed of 155 knots. For the B-57B and C, a speed of 155 knots is also quoted. The B-57E handbook gives a speed of 120 knots with powered rudder and 160 knots without powered rudder, for a safe single engine speed.

The handbook further states that if you are on the final approach with all available drag produced and below 500 feet with safe single engine speed, or slightly lower, you are committed to land. In my opinion, this statement should be given a great deal of respect. If I find myself in this position with a little too much speed, in lieu of a go-around, I intend to full stop even with the possibility of proceeding off the end of the runway.

The B-57 has been operational now for more than two years. Experience has shown that an attempt at a single engine go-around can be highly entertaining; in fact, too much so in many cases. This letter is written in an attempt to get comment from other pilots through this magazine on the subject. I feel we should mix this one up for the benefit of all concerned.

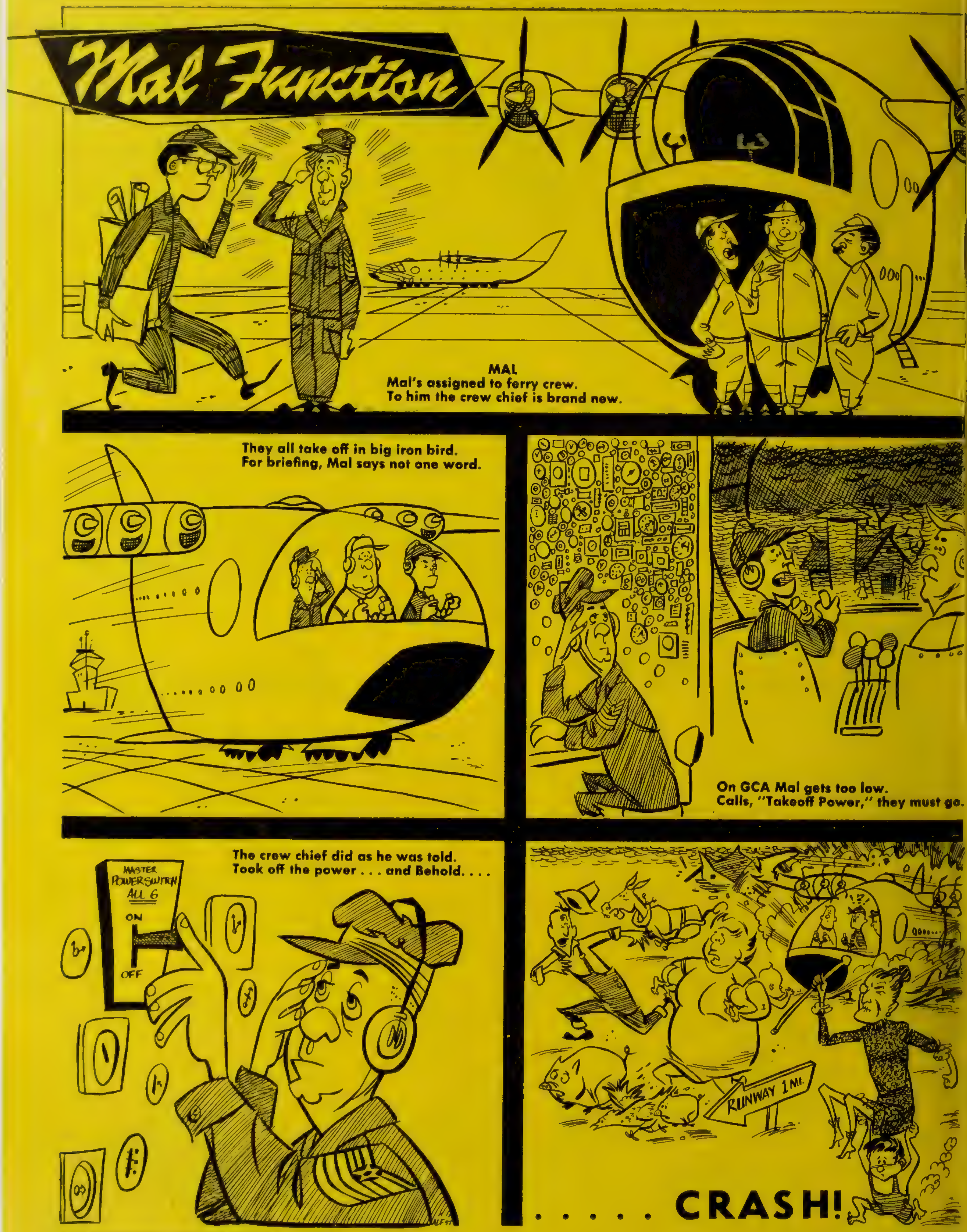
Capt. Paul R. Pitt
Flight Commander
17th Tow Target Sq
Vincent AFB, Arizona

Your comments regarding single engine go-arounds in the B-57 certainly ring the bell. Records on file at the Directorate of Flight Safety Research seem to verify the supposition that too many pilots have taken the subject too lightly.

If there are any other B or RB-57 drivers who care to throw in their two-bits worth, we would like to hear from them.

Getting the Word

Jane Howard is illustrating the subject covered by the article, "What Did He Say?" on page six. Have you ever mumbled a word or two to your copilot, along with a frantic gesture and, in return, received nothing but a "This boy is trying to tell me something" look? If so, the article may set you straight.



MAL

Mal's assigned to ferry crew.
To him the crew chief is brand new.

They all take off in big iron bird.
For briefing, Mal says not one word.

On GCA Mal gets too low.
Calls, "Takeoff Power," they must go.

The crew chief did as he was told.
Took off the power . . . and Behold. . . .

. . . . . **CRASH!**

U. S. GOVERNMENT PRINTING OFFICE . . . 402043

29.1305
LYS

FLYING SAFETY

UNITED STATES AIR FORCE

JULY 1957

THE LIBRARY OF THE
JUL 1957
UNIVERSITY OF ILLINOIS

the Power Plant

File Thirteen

Our cover—front and back—seemed most appropriate to typify our theme of the month, The Power Plant. As we've tried to suggest, there are a lot of things to talk about, yet. Both recips and turbojets come under consideration in this issue. . . . Our April 1957 issue contained an article on jet stream flying, entitled "High Signs." This presentation was a simplified explanation of a complex phenomenon based upon the necessarily restricted experiences of an individual pilot. It contained some observations not entirely supported by later investigation. . . . The October issue of FLYING SAFETY will publish a more detailed and documented discussion which is based on USAF Project "JET STREAM." Believe you'll enjoy this expanded presentation. . . . 'The old Editor changeth, yielding place to new.' With profound apologies to Tennyson, his bit was paraphrased to tell you that your Editor of months past, Major Perry Dahl, is on his way to seek fame and fortune on the other side of the fence. He heard the story about the grass, and is off to Command and Staff School for now and then to you. . . . Meanwhile, back at the ranch, a new shingle, etc., etc.

'til August,

Vernon R Stutts

Order a Personal Copy Today

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Please send Flying Safety Magazine for one year to the following address. Enclosed is a check or Money Order for $2.50. ($3.50 for foreign mailing.) Catalog No. D-301.44.

Name____________________

Address____________________

City____________ State__________

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Perry J. Dahl

Managing Editor
Major Vernon R. Stutts

Associate Editor
Major James W. Bradford

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby

Editorial Asst.
Amelia Askew

Distribution
T/Sgt. William H. Johnson

CONTENTS

Compressor Stalls 2
Well Done 7
Pitch on Props 8
Keep Kurrent 13
Splash Department 14
Payoff in Performance 16
About Aborts 22
What's Your Trouble? 25
Fuel for Fire 26
Crossfeed 28

VOLUME THIRTEEN NUMBER SEVEN

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

Use of funds for printing this publication has been approved by the Secretary of the Air Force and the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use of material. Such action will insure complete accuracy of material, amended in light of most recent developments. The contents of this magazine are informational and should not be construed as regulations, technical orders or directives unless so stated.

USAF PERIODICAL 62-1

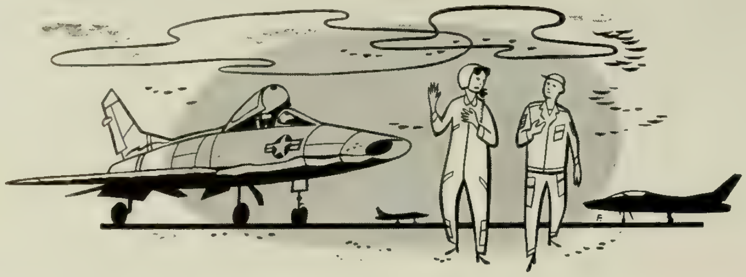
Check with the Chief....

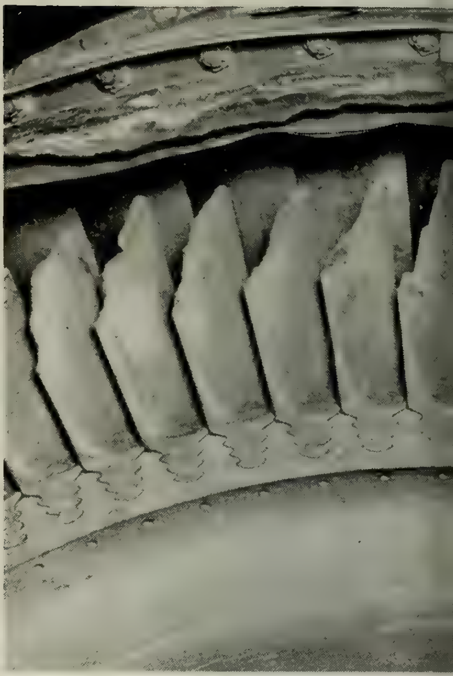
Whether it pushes or whether it pulls, you've got to have power in your bird. When the power plant fails, your mission comes to a screeching halt. Last year's record was bad enough. This year we expect 303 major accidents resulting from engine failure, a careful prediction based on everything we know.

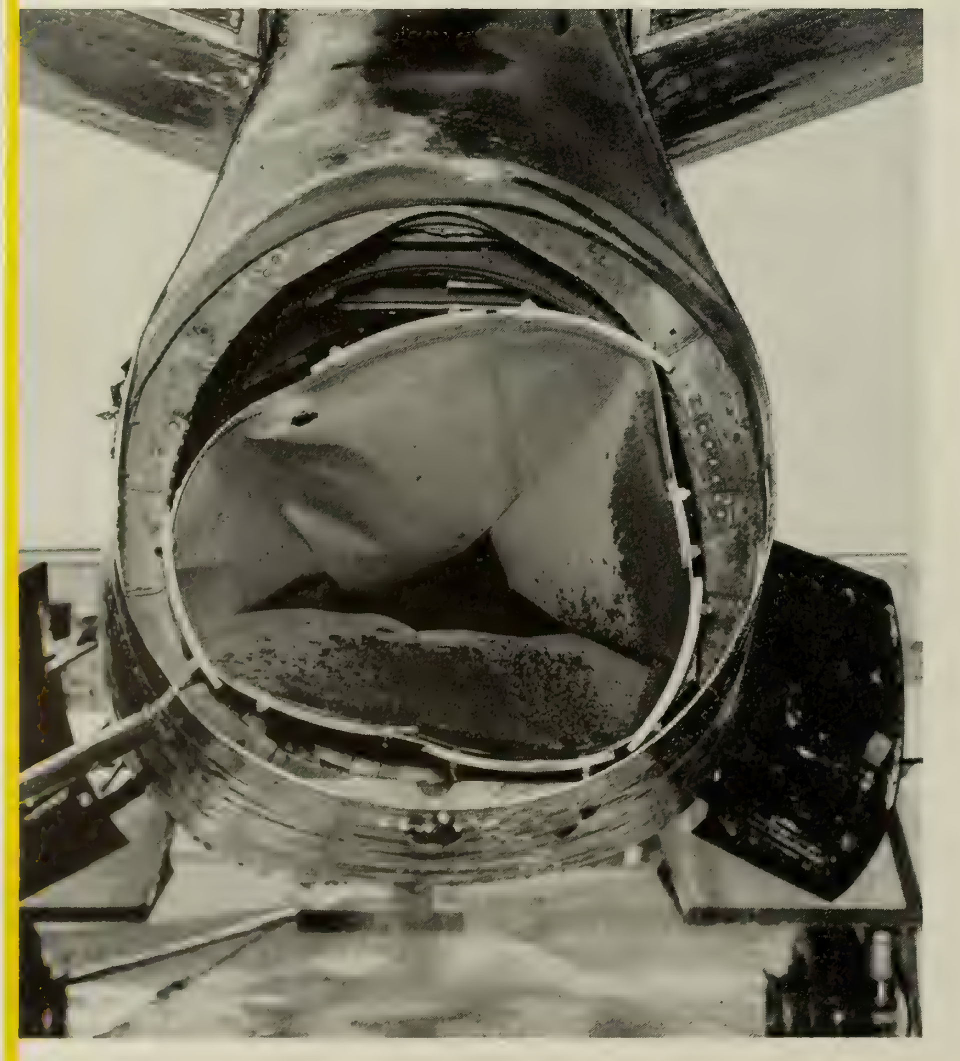
One of the things we know is that some of these accidents are preventable. You can prevent them. Knowledge in this business is always power. A thorough knowledge of the engine in your bird will give you power when you need it most, when you might not have it otherwise.

That puts it up to you. You have to know your power plant as you've never had to know it before. Your next guess might be your last. There isn't time for guesswork anymore. You have to know each little sound and sign that your engine makes, perceive at once the meaning of any change in the pulse and pressure of the bird you ride. So, check with the chief, the crew chief who maintains your aircraft and its power plant. He's the doctor who keeps things up to snuff. Tell him whenever anything goes wrong, no matter how trivial it may seem to you (that's what the Form 781 is for). That little gasp you heard may flash the big red light for him. Now more than ever he too needs to know everything that happens while you're in the air. And now more than ever, you have to know the things he knows. Listen to what he has to say. Take his know-how and skill along with you on every flight. And when you land again, check with the chief. Leave the guesswork to someone else.

The following presentation is based on an article written by Mr. E. E. "Bud" Hopkins, Field Service Representative of North American Aviation, Inc., stationed at the Lockbourne Air Force Base, Ohio. The information here should not be construed to be the last and final word on compressor stalls but instead should serve as a foundation to one seeking a more comprehensive knowledge of these phenomena. The discussion applies to axial compressor stalls in general, rather than to any one type or brand.







If you need convincing that compressor stall can be serious and cause extensive damage, check the photos. All three pictures are of the same F-86F aircraft.

AFTER COMPLETING an hour-long flight, a Lieutenant from the local fighter squadron parked the bird and sat there for a few minutes just staring at the Part II. What to write?

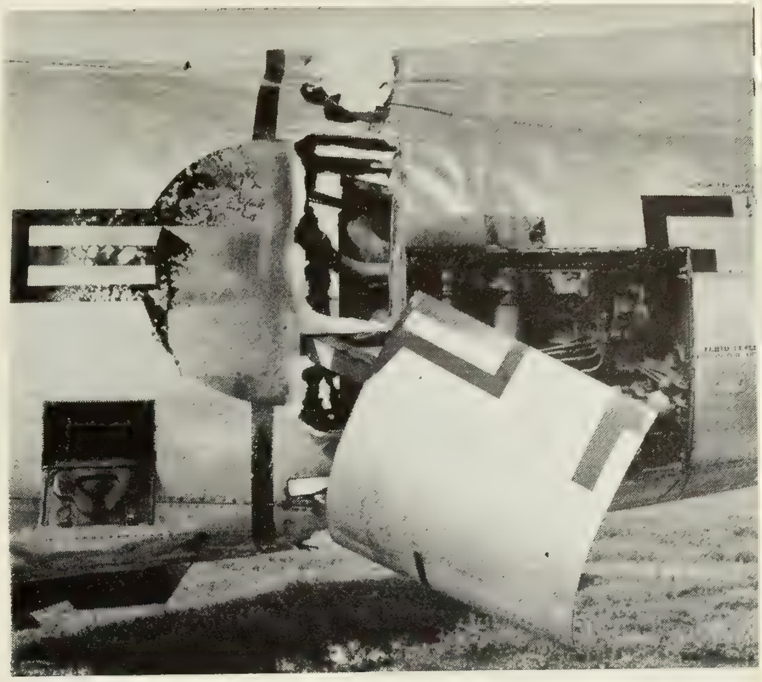
The crew chief saw the puzzled expression and called, "Got troubles, Lieutenant?"

"Yes—but—I don't really know what kind," came the answer. "It was like an engine surge and yet it wasn't. It was too harsh for burner roughness—. I wonder—?"

This was going to take some explaining. Something had happened all right. It just isn't normal for an engine to act like that *without a reason*. But from the sketchy explanation, neither the pilot nor the crew chief could really say what it was.

"Why don't we go and talk to the maintenance officer? He's had about everything happen to him that can happen in flight. Maybe he will recognize this one," the Sergeant finally proposed. "He likes to be clued in on this sort of thing anyway."

"Good thinking, Sergeant, he'll



Compressor Stalls

probably call me on it, anyway," agreed the Lieutenant.

The Maintenance Officer was just reaching for his hat as they entered his office. A civilian was with him.

"Got a minute, Captain?" asked the crew chief. "The Lieutenant's got a real screwy one here. He doesn't know how to write it up and I don't know what to tell him."

"A minute is all I've got," returned the Captain. "I'm on my way down to the Flying Safety Meeting. What's the problem, Lieutenant?"

As the story was unfolded, the Captain interrupted, "Hey, Sam," he called to the civilian who was with him, "are you listening to this? It sounds like what you're going to talk about." Turning to the Lieutenant, he said, "This is Sam Lindley, the Tech Rep on our birds. We were just on our way down to the Fly Safe Meeting where he is supposed to talk about this very thing. Sergeant, tell the line chief to round up everybody he can spare and send 'em down to this meeting. Looks like everybody can stand a shot of it."

"I suspect so," said the Tech Rep. "Lieutenant, from what you've said, I'd say you had a compressor stall. Are you coming to this meeting?"

"Yes, sir," the Lieutenant replied. "I landed a little early so that I could make it. If this is what you are going to talk about, I wouldn't miss it."

"Good," laughed the Tech Rep. "I needed a straight man and you'll be perfect for the job. But don't feel badly 'cause you didn't recognize this thing. There are a lot of other guys who are right in there with you."

As pilots and mechanics settled themselves in the briefing room, the FSO teed off. "I requested this special joint meeting for the simple reason that we have a joint problem. All of us need to know more about compressor stalls. We need to know what causes them, what they mean, and how to prevent them. We had one happen in this squadron less than an hour ago. Bailey, come up here and tell 'em what happened to you and then we'll let Sam analyze."

The sketchy account was quickly repeated, and the Tech Rep was introduced.

"What happened to the Lieutenant here has probably happened to many of you at one time or another. Because it is difficult to describe (unless you call it what it is) probably explains why there aren't more write-ups in the 781. It is a compressor stall. There's nothing new or complicated about it but it can mean trouble. To treat it properly you have to know about the causes involved.

Nothing New

"First of all, let's not deceive ourselves into thinking that compressor stalls are a mysterious offspring from the Jet Age. This is a problem that has been lived with since the days of turbo-supercharged, reciprocating engines. It has merely increased in stature with the advent of jet engines.

"To get at this thing, let's begin with the known and lead to the unknown. The unknown in this case happens to be the compressor stalls, and the known, the stalling characteristics of the basic airframe itself. It is general knowledge that an airplane wing can be stalled by increas-

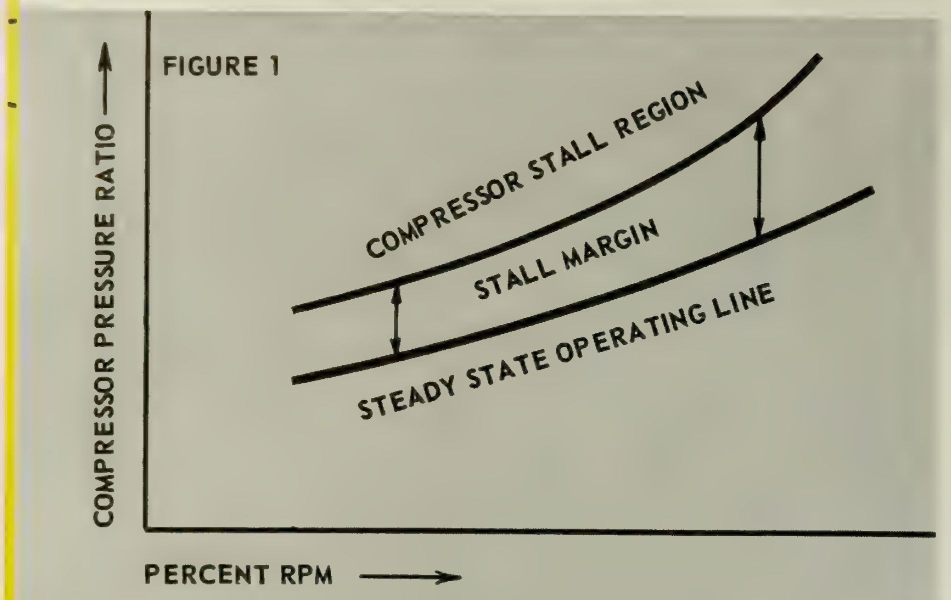


FIGURE 1

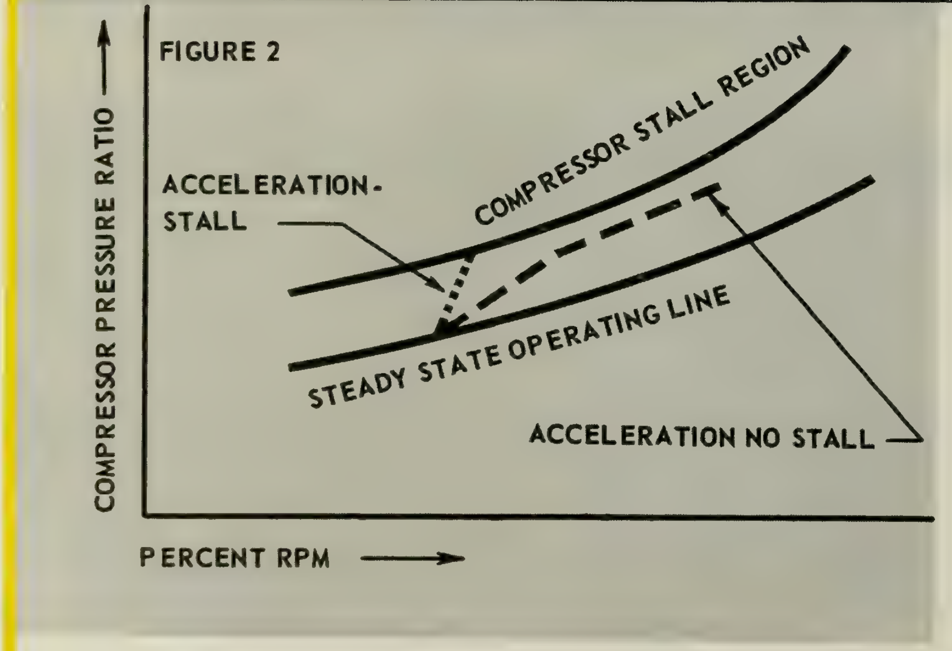


FIGURE 2

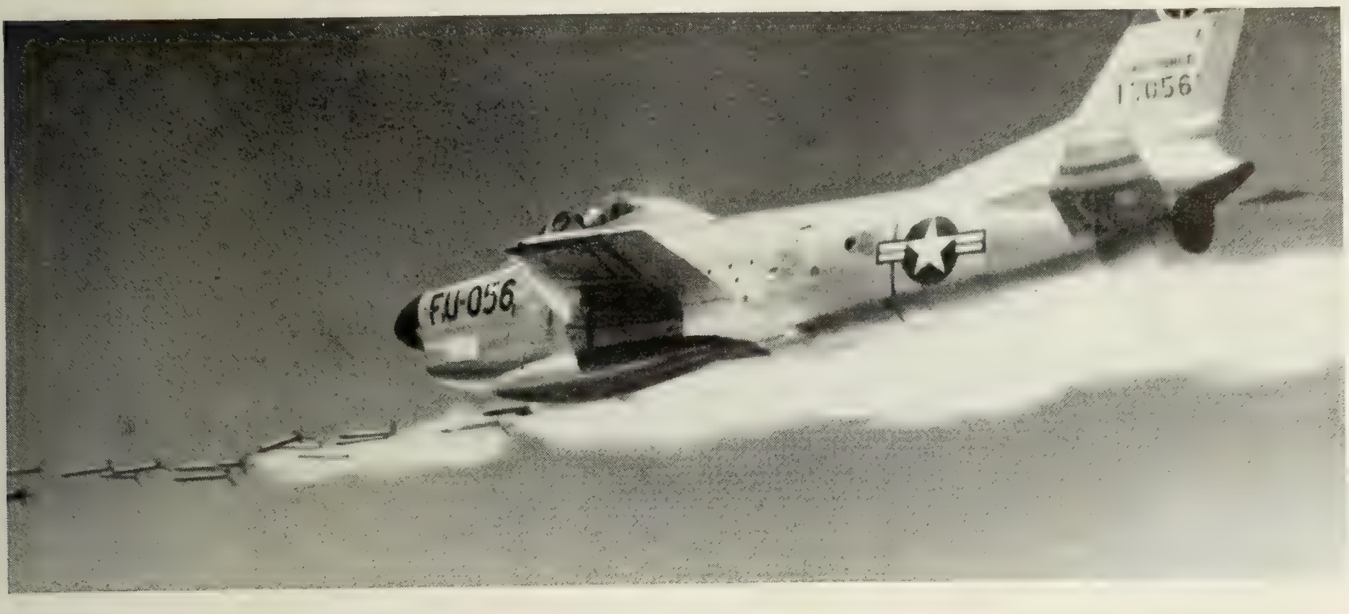
ing the angle of attack. The air passing over the top of the wing at very high angles of attack tends to take the path of least resistance and thus begins to separate from the wing. This results in a loss of lift. The airplane is in a stalled condition and no longer able to accomplish its intended purpose.

"Now, how does this apply to a jet engine? In this way: Each compressor rotor blade is essentially a "tiny" wing and is affected in very nearly the same manner as the airplane wing. Bear in mind this difference: That whereas the airplane wing may be "flown" into a position of high angle of attack, the rotor blade is fixed. But virtually the same results may be obtained by varying the relative magnitude and direction of inlet airflow velocity (per cent of RPM remaining constant) which will, in effect, vary the blade angle of attack. Conversely, if the airflow remains constant and the rotor RPM is varied, you'll get the same results. You can see then that the rotor blade effectiveness is a function of airflow velocity and rotor RPM.

"Now," continued Sam, "after touching on these preliminary factors, let's proceed to compressor stalls. There are basically two ways of inducing a compressor stall—and notice the word I've used, *inducing*. They are:

"(1) Reduction or distortion (localized reduction) of airflow velocity at the engine inlet while RPM remains constant. These are sometimes called "cold stalls." They are induced by a distortion of airflow at the intake due to distortions originating at the duct entrance or within the duct itself. This condition would, in most cases, be more prevalent on airplanes where the inlet duct design is such that it is susceptible to distorted airflow. The name 'cold stalls' (also a 'two-dimension stall') stems from the fact that the exhaust gas temperature does not increase noticeably when this abnormal condition exists. You also can get airflow distortions leading to a cold stall with well designed ducts during maneuvers. Any time you get the bird into extreme angles of attack or yaw, you should watch for a compressor stall.

"(2) Improper operation of fuel controls and exhaust area controls—when applicable. 'Hot Stalls' are induced by improper scheduling of fuel to the burner cans. This improper scheduling can be introduced by a malfunctioning fuel control system



Formation flying, gunnery and high angles of attack can result in compressor stalls.

(either hydro-mechanical or electronic). In this case the malfunction would probably reveal itself upon throttle burst. In any event it would result in an abnormally large amount of fuel being distributed to the burner cans. This fuel, when burned, heats the air and makes it expand in volume. The exhaust gas seeks a place to relieve itself. The proper place for the hot gases to escape would be out through the nozzle diaphragm, turbine wheel and through the tailpipe.

"However, the physical construction of the nozzle diaphragm and the tailpipe is such that it allows only a certain volume of gases to escape for a given time. With the extra unwanted fuel burned and expanded, it cannot all escape by this route. Consequently, it begins to back up and oppose the air passing over the compressor rotor blades. This results in a loss of airflow velocity and a compressor stall is induced.

"But, that isn't all. The compressor discharge pressure which has been waging this minor warfare against the compressor inlet airflow velocity, now suddenly finds a place of escape and away it goes out the tailpipe and even the intake. This is possible because the engine is stalled and the airflow velocity and volume have decreased considerably.

"These conditions cause a reduction in engine RPM which is sensed by the engine fuel control, and a greater amount of fuel is scheduled to the burner cans in an attempt to raise engine speed.

"This initiates the whole chain of events again and we have what is known as pulsation or surge. In the meantime, during this little fracas, the EGT is left on its own, and rises to values usually in excess of prescribed limits. The rapidity of this rise, of course, is consistent with the severity of the stall.

Recognition

"Recognition of a compressor stall is usually no problem; the vibration that accompanies a stall is enough to shake your eyeteeth loose. However, it is possible to experience a milder stall which would not even be evidenced by instrument indications. If this particular type occurs, a 'hang up' in RPM will be noted somewhere in the region between 50 per cent and 80 per cent (critical stall region). A gradual rise in EGT would also occur.

"As far as sound is concerned, this would be dependent upon the extent of the stall. Sound will vary in intensity from a low rumble to something like pistol shots. In extreme cases it is more like cannon firing. As you can see, this could 'clank up' a pilot slightly, if he didn't know what to expect.

"Now a few words on the basic types of compressor stalls. There are three classifications that may be used to assort stalls:

- A partial stall, which is the mildest of the three and is usually tolerated insofar as compressor performance is concrened. This one involves multiple regions of stalled flow extending over only a part of blade height or a limited number of compressor stages. Transition from partial stall is gradual. As the airflow velocity and volume are reduced, the areas of partial stall tend to group together and form a complete stall.
- A complete stall should be avoided if at all possible. A persistent stall of this type not only penalizes the engine performance but also reduces engine life. This type not only

causes high vibratory stresses on the compressor blades but (what may be worse) hot spots on the turbine wheel. By the way, both of these are excellent fatigue aggravators.

"The complete stall is characterized by the fact that it has only one stalled region extending over the full blade height and full length of the compressor. (Consider the wing in a complete stall for comparison.)

"Transition into a complete stall is abrupt. The engine has probably been afflicted by a partial stall which is suddenly transformed into a *complete* stall. Whenever a stall of this type occurs, it requires extreme, corrective measures to stop it.

- Stall surge is the third and most severe condition. We covered this pretty well in the explanation of the "hot stalls." I did not tell you, however, that this condition can lead to either a rich flameout (wet out) or a lean flameout. The reason is that with stall surge, the net airflow through the engine varies with time while airflow during complete or partial stall remains constant. This produces variations in the fuel-air ratio and velocities in the burners and often leads to the flameout conditions.

What You Can Do

"Naturally, upon becoming aware of the problem, my first question as a pilot or maintenance man would be: 'How can I steer clear of these situations or what can I do to diminish the intensity of these stalls?' As for the pilot, the following procedures should prove beneficial:

- Treat the throttle with respect. Although the latest designs allow for throttle bursting, be reasonable about it.

- Bear in mind that altitude increases have an adverse effect on compressor operation. This is a result of what is kown as 'Reynolds Number Effect.' That classy title is just a way of saying that the air becomes thinner as the altiude is increased and therefore has difficulty in following the contours of the airfoil section of the compressor blade. This causes the stall margin to decrease.

"On Figures 1 and 2, you will notice the two curves representing steady state operation and the stall region boundary. The small margin between the two curves is called the stall margin. To obtain optimum engine performance, it is necessary that these curves be close together. In other words, we might say the engine is operating very close to a stall in order that the utmost in thrust may be realized. Figure 2 illustrates a normal engine acceleration and an abnormal acceleration.

- Avoid abnormal flight attitudes, whenever it is not a requirement of your mission. Remember that flying which adversely affects the airframe performance has virtually the same type effect on the compressor.

"If a stall actually occurs, here's what to do: First and foremost, retard the throttle. This will cause the fuel to flow to decrease to a minimum schedule and the engine will begin to decelerate. Reducing the fuel flow permits the gases in the combustion chambers to flow through the nozzle diaphragm and the pressure ratio (between compressor inlet and outlet) is reduced low enough to bring the compressor out of stall.

"This is true in most cases. At high altitudes, however, stalls cannot always be completely corrected by chopping the throttle, because of the high flight-idle setting. Retarding the throttle past the idle detent introduces a possibility of flameout. But go ahead and pull it back within reason. If this doesn't work, leave it at idle and correct any abnormal attitude you may be in. The attitude may have been the cause. Diving the bird will help. The object here is to increase the airflow over the compressor rotor. Or, do all three simultaneously.

"For you lads in the maintenance business, the same deal about handling the throttle applies. Use extreme care in fuel control adjustments and throttle linkage adjustment. In short, follow the technical order.

"There are a few more factors that may be conducive to stalls. They are:

- Temperature effects. As the temperature decrease, the stall margin decreases. This tells you that a stall problem would be more likely to occur during cold weather operation.

- Rocket and gun firing. This can cause stalls in several ways. First, the rocket and gun blasts create disturbances in air entering the duct, if located too near. These disturbances provide ideal conditions for cold stalls.

"Second, if the exhaust gases are allowed to enter the duct, they usually cause hot stalls. This happens because the sudden variation in temperature of air produces a sudden change in airflow through the compressor, much like during surge. In addition, the air is depleted of oxygen and the mixture suddenly becomes too rich.

- Close formation flying. During such flights, it is possible to be exposed to the exhaust of the leading aircraft. This produces the same effects as the rocket firing that I just described.

"As a final note I want to leave you with this thought. It is actually for you maintenance troops, but it is also important for you pilots because you're the ones who will have to report it. A compressor stall which cannot be corrected by adjustments of fuel scheduling may usually be traced to an improper size (too small) nozzle diaphragm. However, I want to point out that the same thing can be produced by the pilot by improper operation of the tailpipe area control or trim setting.

"What I have tried to say in this long harangue is simply this: Compressor stalls can be dangerous just like those that you get on the airplane as a whole. But just like the airplane stall, you can stay out of compressor stalls. It is mainly a matter of knowing what causes them.

"The two types are almost identical. With either case, they sometimes happen when you don't expect them to. But when they do, you can do something about them. What you do will either correct the condition or make it worse, depending on how fast you recognize your trouble and apply corrective action.

"My last point is this, and I can't overemphasize it: Pilots and maintenance people must work together on these things if you are to have reliable engines and airplanes. A mechanic can't fix something he doesn't know about, and a pilot can't complete missions without reliable engines. The one depends on the other —and entirely on you. ▲

WELL DONE

First Lieutenant
Peter T. Nichols
6630th Radar Eval ECM

LT. PETER T. NICHOLS was the pilot of a B-29 aircraft on what was to have been a ten-hour navigation mission. He was attached to a Radar Evaluation ECM Flight, operating out of Goose Air Base, Labrador. Gross weight of the aircraft was 120,679 pounds.

Immediately after takeoff, No. 3 showed signs of improper operation. At flaps-up altitude, No. 1 lost all power and had to be feathered. Lt. Nichols declared an emergency and made a turn to crosswind leg at 650 feet. Shortly after this turn, the propeller on No. 2 began to overspeed. An immediate, though unsuccessful, attempt was made to reduce the RPM to 2800. Instead, it dropped rapidly to 1800 then surged back to 2900. Throttle was closed completely and when the RPM continued to rise, Lt. Nichols feathered No. 2. The B-29 was losing altitude at 200 feet per minute, at 175 mph. Full right rudder was required to hold it on a straight course.

The pilot declared "May Day" and requested to land on a runway that crossed the takeoff runway at 90 degrees since there was not enough altitude to complete a normal pattern. Clearance was granted. He made his turn to final at approximately 600 feet and the aircraft touched down on the first 1000 feet of the runway.

Investigation revealed that both engines and propellers malfunctioned as result of materiel failure. An aircraft accident was averted, however, because of the calm and capable performance by Lt. Nichols. WELL DONE!

Joseph C. Dabek
Hamilton Standard

PITCH ON PROPS

ANYBODY WHO has experienced a sudden propeller overspeed knows that it isn't fun. The whine of the engine and the tachometer needle against the peg make you wish that you were some place else. So, what do you do when you're in this fix? You reduce power. Assuming, of course, you have some air under you, plus airspeed, or both—and press the button, hoping that the darn thing will feather. If it does, you'll breathe a sigh of relief and hope that the copilot noticed how cool you remained during the whole operation. If it doesn't feather, then you'll bone up on the problem of flying an airplane with a windmilling prop.

Not only is this situation hard on you, but the engine which went through the overspeed didn't enjoy it, either.

Wouldn't it be nice to have a prop that didn't turn up quite so fast if some malfunction caused an overspeed? Also, if for some reason that prop couldn't be feathered, wouldn't it be nice still to get some useful thrust out of it? This is exactly what has been done in the model 34G60 propeller which is replacing the 24260 prop on all C/KC-97 aircraft. The magic words are "pitch lock."

In this case, it's a hydraulic lock (like you avoid in the engine) because that is the simplest arrangement to design and maintain when provided as an added feature in the proven hydromatic propeller.

Four of these 34G60 props have been going through a service test at Westover Air Force Base for several months now, and we've had a chance to get a first hand look at pitch lock operation. The catch is that during this test, on several different occasions, one or more propellers were locking pitch at an RPM lower than expected. The resulting prop operation was something unheard of since controllable props came in 'way back in the early thirties. This confused the troops.

The following excerpt of a Form 1 write-up will give you an idea what happened:

"A simulated, three-engine approach with No. 4 set at 1900 rpm and 19″ manifold pressure, and Nos. 1, 2 and 3 set at 2550 rpm. A go-around was made with the No. 4 engine still set at 1900 rpm and 19″ Hg.

"Later, power was reduced to 2550 rpm on Nos. 1, 2 and 3 and held around the pattern for another three-engine approach. Turning final, No. 1 went to 1850 rpm; Nos. 2 and 3 to 2200 rpm. No. 2 was selected as master and the sync lever placed in full increase. No. 1 engine went to 2200 rpm; Nos. 1, 2 and 3 remained at

Here is an article about a new piece of equipment which is not electronic, has no wires, and no cockpit controls. It gets into the act automatically.

2200 rpm and No. 4 went to 2700 rpm. The manual switch would not increase the RPM on Nos. 1, 2 and 3 engines. All four, high-limit lights were on. Manifold pressure was approximately 35 inches. A landing was made with Nos. 1, 2 and 3 at 2000 rpm and No. 4 at 2700. After landing, a prop check was made, using Nos. 1 and 2 as masters, and the check was completed satisfactorily."

Following this incident, some time was spent in trouble-shooting the prop system, however, nothing tangible was found to account for any prop malfunction. The aircraft was released for local area until this problem could be wrung out. On one of these flights it happened again, but this time we had a clue. Here is an excerpt of this flight report:

"Began go-around: A/C called for 2700 rpm, throttles applied to 55" Hg, all four props surged to approximately 2850 rpm. RPM stabilized at 2680 for No. 1, at 2700 for 2 and 3, and at 2640 for No. 4. A/C called for climb power. Throttles were retarded and props followed to 2200 rpm—NOTE: sync lever was not moved—governor lights stayed on. As the sync lever was retarded through approximately the 2500 rpm position, the governor lights went out—sync lever held in that position for approximately five seconds. Sync lever brought back to 2200 rpm before responding. RPM set 2550 and all props followed smoothly and sync was good."

You will note that in both of these instances the apparently erratic prop operation occurred right after a go-around. Subsequent ground checks were satisfactory. Furthermore, the second case shows definitely that the props were behaving as if in fixed pitch in that the RPM decreased when the throttles were pulled back.

Following the second incident, a test flight was made during which the pitch of any one or all four props could be locked by *purposely* overspeeding the engines with very rapid throttle movement to about 2900 rpm in a go-around. Excessively fast throttle application was necessary to engage the pitch lock.

It was later found that part of the pitch lock mechanism, the bleed shut-off valve, on all four props was set to close lower than the specified 3000-3100 engine RPM. This service test proved that familiarity with the pitch lock feature was very desirable. Here's what you should know about it.

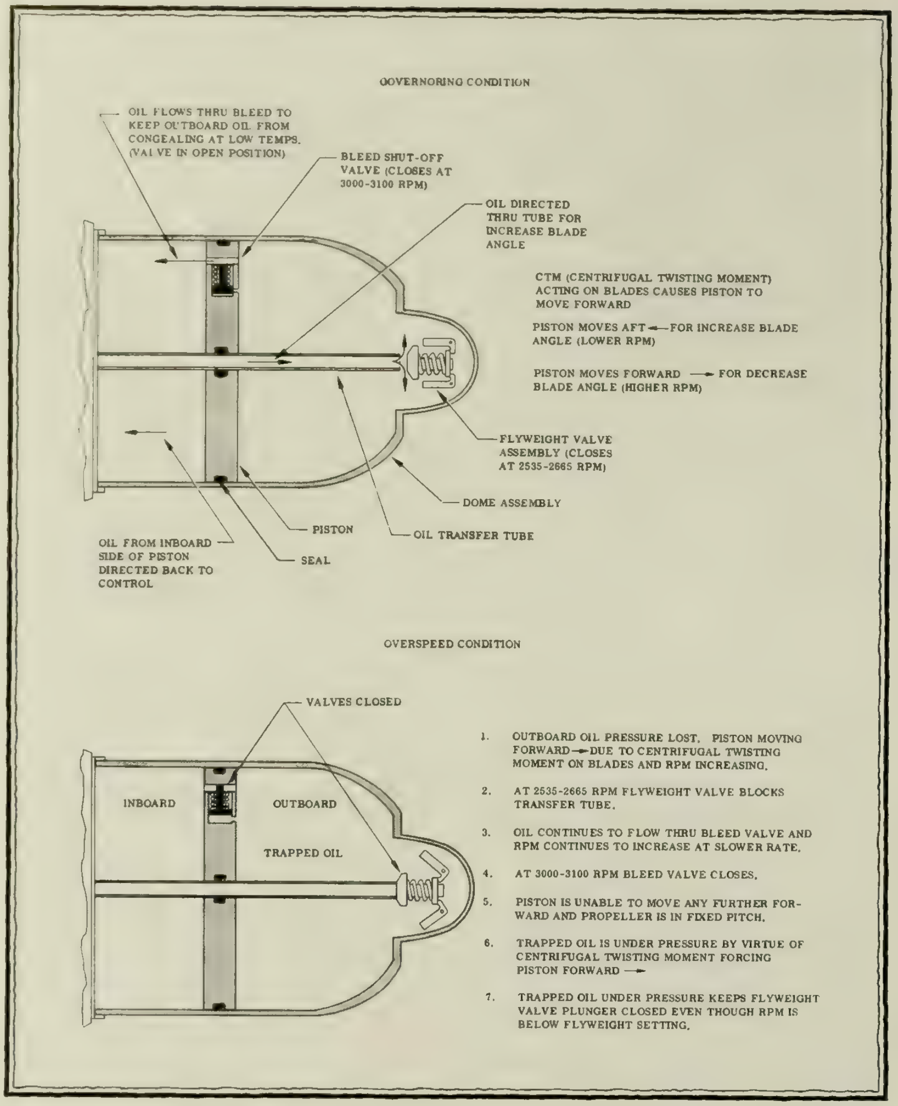
With the present-day powerful engines, aircraft speeds are at the point at which the windmilling RPM of a propeller on the low pitch stop becomes an important consideration. If the blades turn toward the low pitch position because of some malfunction, a severe overspeed can result. Under certain conditions, this overspeed can occur rapidly enough to cause engine damage before corrective action can be taken. If the feathering system has been rendered inoperative, the propeller will continue to windmill on the low pitch stop and produce undesirable drag affecting airplane performance.

In the event of a malfunction which causes the blades to move toward low pitch, it is desirable to limit the overspeed to a moderate RPM. It is also desirable to permit continued operation at reduced power and normal RPM with the propeller still delivering thrust if the situation demands.

In order to understand pitch lock operation, it is good to know some of the fundamentals of prop governing.

The governor is basically a speed control. The engine RPM that you select in the cockpit by means of the prop master lever or toggle switches, will tend to remain constant regardless of airplane attitude or changes in power setting. This is done by automatically changing the blade angle to take a larger or smaller bite of air, which is achieved by oil pressure acting on a piston in the dome. Oil pressure moving the piston forward decreases the blade angle and the RPM goes up while oil pressure moving the piston aft increases the blade angle, and the RPM drops. (It must be remembered that centrifugal twisting moment—CTM—which you've heard of before, is always acting to drive the blades to a zero angle. Increased pitch oil pressure is the opposing force.)

A pilot valve connected to flyweights determines whether the blade angle should be increased or decreased. When the piston is moving forward under oil pressure and CTM, the oil on the other side must move out of the way and is directed back to the control and vice versa.


GOVERNORING CONDITION
OIL FLOWS THRU BLEED TO KEEP OUTBOARD OIL FROM CONGEALING AT LOW TEMPS. (VALVE IN OPEN POSITION)
BLEED SHUT-OFF VALVE (CLOSES AT 3000-3100 RPM)
OIL DIRECTED THRU TUBE FOR INCREASE BLADE ANGLE
CTM (CENTRIFUGAL TWISTING MOMENT) ACTING ON BLADES CAUSES PISTON TO MOVE FORWARD
PISTON MOVES AFT ← FOR INCREASE BLADE ANGLE (LOWER RPM)
PISTON MOVES FORWARD → FOR DECREASE BLADE ANGLE (HIGHER RPM)
FLYWEIGHT VALVE ASSEMBLY (CLOSES AT 2535-2665 RPM)
DOME ASSEMBLY
PISTON
OIL TRANSFER TUBE
OIL FROM INBOARD SIDE OF PISTON DIRECTED BACK TO CONTROL
SEAL
OVERSPEED CONDITION
VALVES CLOSED
INBOARD
OUTBOARD
TRAPPED OIL

1. OUTBOARD OIL PRESSURE LOST. PISTON MOVING FORWARD→DUE TO CENTRIFUGAL TWISTING MOMENT ON BLADES AND RPM INCREASING.
2. AT 2535-2665 RPM FLYWEIGHT VALVE BLOCKS TRANSFER TUBE.
3. OIL CONTINUES TO FLOW THRU BLEED VALVE AND RPM CONTINUES TO INCREASE AT SLOWER RATE.
4. AT 3000-3100 RPM BLEED VALVE CLOSES.
5. PISTON IS UNABLE TO MOVE ANY FURTHER FORWARD AND PROPELLER IS IN FIXED PITCH.
6. TRAPPED OIL IS UNDER PRESSURE BY VIRTUE OF CENTRIFUGAL TWISTING MOMENT FORCING PISTON FORWARD →
7. TRAPPED OIL UNDER PRESSURE KEEPS FLYWEIGHT VALVE PLUNGER CLOSED EVEN THOUGH RPM IS BELOW FLYWEIGHT SETTING.

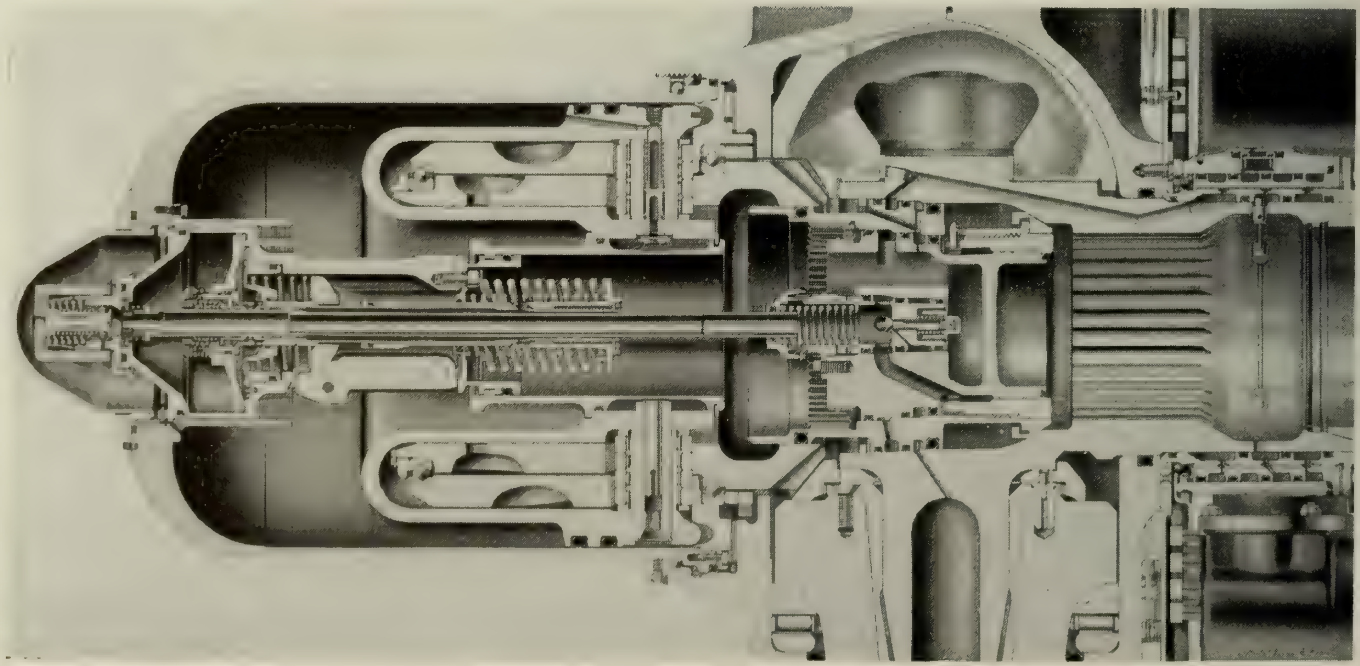
In a prop overspeed, increase pitch oil pressure is lost for some reason and, since CTM is left all by itself, it will turn the blades to a lower angle and this is when things start winding up. Now, if at some specified RPM, the passage for the return oil could be blocked such that the oil on the increase pitch side of the piston would restrict forward piston movement, the blade angle could not decrease and we have the makings of an overspeed limiting device. This is basically what pitch lock is.

Pitch lock is completely contained within the dome assembly and will restrict blade angle change toward a lower angle at a pre-set RPM. It consists of two basic parts: a flyweight valve just under the dome cap, and a bleed shut-off valve in one of the cam roller shafts.

The flyweight valve blocks the flow of oil from the increase pitch side of the dome piston at an RPM of 2535-2665. The trapped oil will hold the valve closed, however, oil pressure toward increase pitch is always capable of opening the valve as during the feathering operation.

The bleed shut-off valve assembly will block the flow of oil from the increase pitch side of the piston when the RPM reaches the 3000-3100 range. This valve is normally open and provides a path for circulation of oil in the dome as is accomplished by the

Below, this is a cut-away of the mechanism.



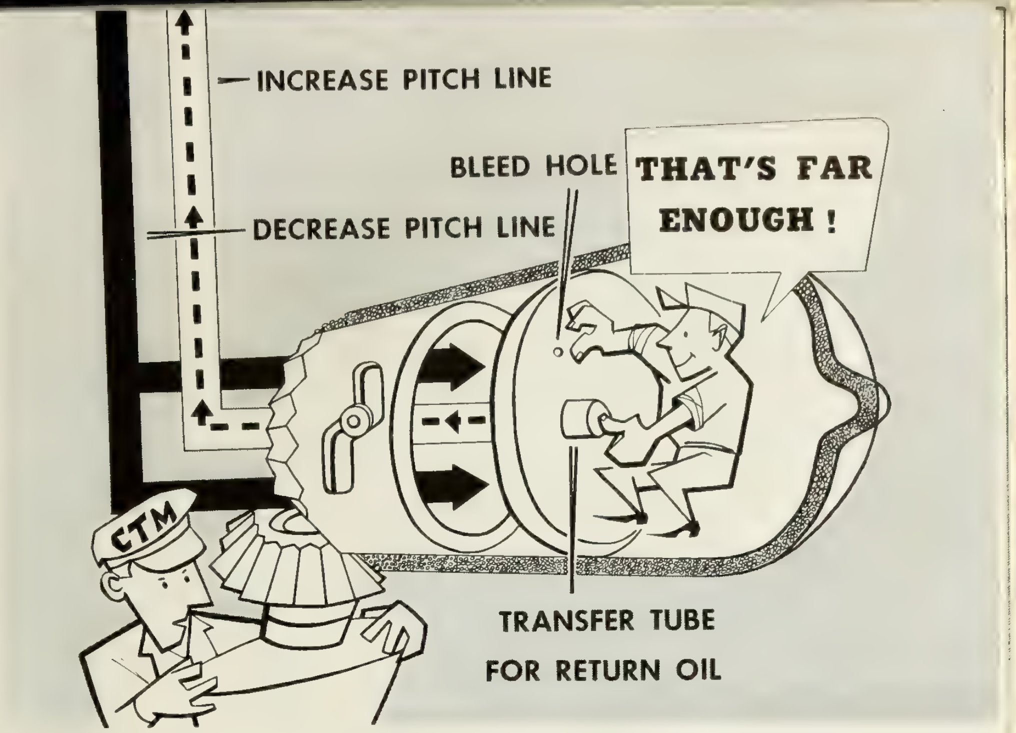
piston bleed hole on other hydromatic propellers. Once closed, this valve is held closed by trapped or by increase pitch oil pressure until the RPM is reduced to 1500-1700. The trapped oil on the increase pitch side of the dome piston creates a hydraulic lock, as you can see, if this area is perfectly sealed. Remember, CTM is trying to turn the blades to a zero blade angle but cannot because the trapped oil is restricting piston movement except for that resulting from minor leakage past the seals.

Let's see how pitch lock normally works. Suppose while you're cruising along comfortably, something unpleasant like the main oil pump in the prop control jams and prop oil pressure is lost. This would be the sequence of events:

- Centrifugal Twisting Moment would start turning the blades to a lower angle and the RPM would start rising. The piston in the dome would be moving forward.
- At 2535-2665 rpm the flyweight valve would close and block the flow of return oil from the increase pitch side of the dome piston at the end of the oil transfer tube.
- Since the bleed shut-off valve is still open and increase pitch oil is flowing through, the RPM would continue to rise, only at a slower rate.
- At 3000-3100 rpm the bleed shutoff valve would close and forward piston movement would be stopped because the oil on the other side is in the way.
- The RPM would not increase any higher and, assuming that you haven't already jabbed the feathering button, you would probably do so now. If the prop could not be feathered for some reason, or if you felt you could use the "bezazz" available from the wounded powerplant at reduced throttle, you would pull the throttle back on the particular engine and the RPM would decrease. The blades are effectively at fixed pitch.

In this case you must remember that the bleed valve will open at 1500-1700 rpm, therefore, with the prop in fixed pitch, airplane maneuvers or throttle manipulation which would cause the RPM to approach this value should be avoided.

- The flyweight valve would remain closed even though the RPM is reduced below the flyweight setting (2535-2665) because the trapped oil is under pressure by virtue of CTM pushing the piston forward.



What does pitch lock do on takeoff? Since the takeoff RPM is above the flyweight valve setting, the valve tries to close. However, increase pitch oil pressure over-rides it and the blade angle continues to *increase* to achieve governing. Should an overspeed occur on takeoff, the pitch lock mechanism will lock at 3000-3100 rpm. The acceleration of the airplane, however, will continue to cause an increase in RPM. The blade angle during takeoff is near the low pitch stop, therefore, reducing power on the particular engine would be necessary immediately.

Reverse Pitch

Now about reversing. In some instances where rapid throttle movement in the reverse quadrant is necessary, an RPM above the flyweight setting may be reached as the blades pass through flat pitch. To assure that the flyweight valve will not interfere with reversing, a mechanical lifter is located on the outboard end of the oil transfer tube which is raised during reversing and prevents the flyweight plunger from seating until after the prop is unreversed.

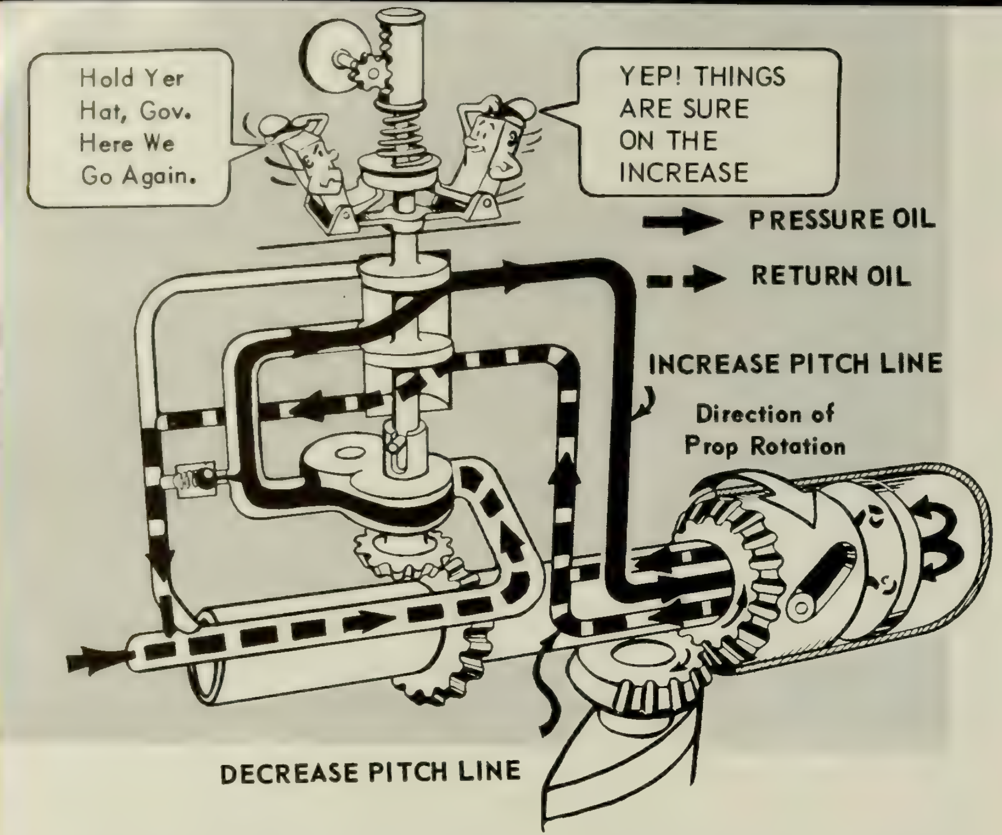
The pitch lock will not normally actuate unless there is some malfunction causing an overspeed. The limiting RPM of 3000-3100 was selected because it is high enough to be out of the normal operating range and yet low enough to avoid severe engine damage. Of course, if you really tried, you could probably get an RPM surge this high in a go-around by starting off at a low airspeed with the prop master control lever set at takeoff and jamming the throttles forward.

Realizing that in some instances this might happen when you are in need of a lot of power and right now, it would pay you to know whether or not you have locked pitch especially if prop operation doesn't look quite right; also, how can you get out of this thing when you're in it.

Say that you make a go-around during which the RPM surges above 3000, let's see what will happen. If this seems too complicated now, we would suggest reading it again after your first check ride when you'll have seen it actually happen.

- After the surge, the RPM will drop to the governor setting since increase pitch oil pressure will unseat the flyweight plunger and governing will continue.
- A normal power reduction can be accomplished to bring the RPM below the flyweight valve setting and, although the bleed shut-off valve may be closed, constant speed operation will not be noticeably affected. With the bleed shut-off valve closed, normal oil circulation will be terminated; however, there will be no immediate obvious change in propeller operation.

NOTE: If the throttles are retarded or if airspeed is reduced by climbing while the master lever remains at the takeoff setting a locked pitch condition will result. That is, the RPM will decrease (follow throttle movement and/or airpseed) since the governor is calling for a lower blade angle such


Hold Yer Hat, Gov. Here We Go Again.
YEP! THINGS ARE SURE ON THE INCREASE
PRESSURE OIL
RETURN OIL
INCREASE PITCH LINE
Direction of Prop Rotation
DECREASE PITCH LINE

that oil pressure is applied to the decrease pitch side of the dome piston but the piston can't move, so the RPM will decrease.

The flyweight valve will remain closed, even though the RPM may drop below 2535-2665, because the pressure of the trapped oil will be acting on the plunger. As long as the governor is calling for a decrease in blade angle when the bleed valve and flyweight valve are closed, the propeller will remain in fixed pitch.

Therefore, to determine whether any or all of the propellers have the bleed valve closed, the following check can be made:

- After the RPM has stabilized as we described above, the throttles may be retarded while leaving the propeller master lever in the takeoff position (max RPM lights on). If the RPM decreases, that is, follows throttle movement, it indicates that the bleeds are closed and the propellers are in fixed pitch. If on one or more engines the RPM remains at the takeoff setting, this indicates that the bleed valve is not closed on that particular propeller. It follows then that while the flyweight valve closes when the throttle is retarded from an RPM above the flyweight setting, governing will continue if the bleed valve is open. In this case piston movement toward a lower blade angle condition is limited by the rate of oil flow from the increase pitch side of the piston through the bleed valve.

To observe this condition, the following checks may be performed:

- While cruising at an RPM *below* the flyweight setting, 2400 for example, one of the throttles may be chopped which will result in the RPM dropping but immediately returning to the governor setting.

Then while governing at an RPM *above* the flyweight setting, 2670 for example, when the throttle is chopped the RPM will drop but will return to the governor setting slowly compared to the first case. This indicates that pitch change toward a lower blade angle is retarded by virtue of the flyweight valve being closed and the increase pitch oil is being displaced through the bleed shut-off valve.

To release the bleed shut-off valve (if closed) the RPM on the particular engine or engines may be reduced to 1500-1700 by toggling and constant speed operation will resume.

On Go Around

What does all of this mean? It means that even though you might experience an RPM surge above 3000 during a go-around, with a normal power reduction you'll probably never know that the bleed valves may be closed and the conditions are set for lock pitch. That is, during a normal power reduction after the throttles are retarded a bit you also decrease the RPM with the prop master control lever. Pulling the prop control lever back is a round-about way to tell the blade angle to increase. The increase pitch oil pressure then unseats the flyweight plunger and you're back in business at rated power.

It also means that if the throttles are retarded more than usual before the prop control lever is moved, you will get a pitch lock indication right then if the bleed valves are closed. To get out of this condition all you have to do is pull the prop control lever or toggle switch back to an RPM setting below the tach reading, and the flyweight valve will be unseated by increase pitch oil pressure. To be complete about it though, it is advisable to open the bleed shutoff valves by toggling the RPM to 1500-1700. This will insure normal RPM control for the next approach.

If you haven't already dozed off by now with all this jabber about CTM, governing, and increase pitch oil pressure, you are probably expert enough to go back to the excerpts of the Form 1 writeups and tie pitch lock in with those incidents.

We've painted a glowing picture of pitch lock. Maybe it reads like a sales brochure on the subject and you are sitting there, nodding your head and smiling cynically. Okay, try these three on for size and see whether the foregoing theory talk is worth anything.

One commercial airline had three separate cases where this has come into operation.

In the first case, a Stratocruiser out of Honolulu experienced an overspeed to the pitch lock setting upon reaching cruising altitude. The pilot retarded the throttle to 2250 rpm after the pitch lock actuated. He returned to Honolulu.

In the second case, a Stratocruiser two hours and 24 minutes out of San Francisco had a runaway to the pitch lock setting and the pilot pulled the throttle back to 2250 after pitch lock actuated. He returned to 'Frisco.

En route to Fairbanks from Seattle, a third B-377 experienced an overspeed to 3100 rpm following which the pilot reduced power to 1875. The aircraft landed at Gustavus, Alaska. Although I've never been to Gustavus, I understand there was no sweat.

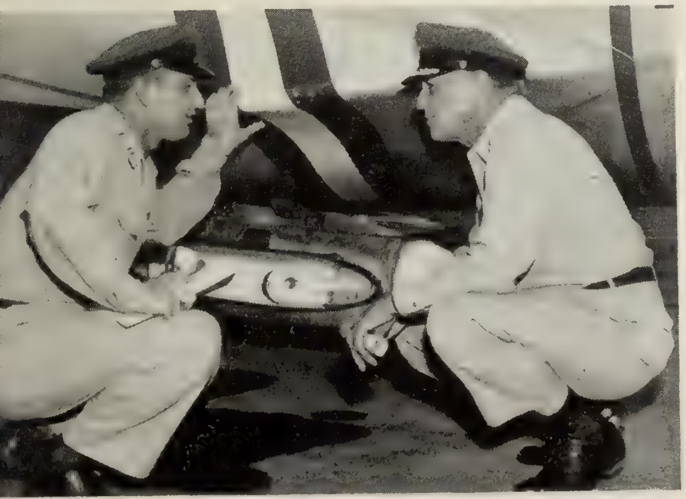
So you see, it does work. Our word to the wise is to know about pitch lock, know how you can get into it and out of it and that's the end of it. Perhaps some day pitch lock will give you a hand in a situation which could have otherwise been very hairy, and away you'll go. ▲

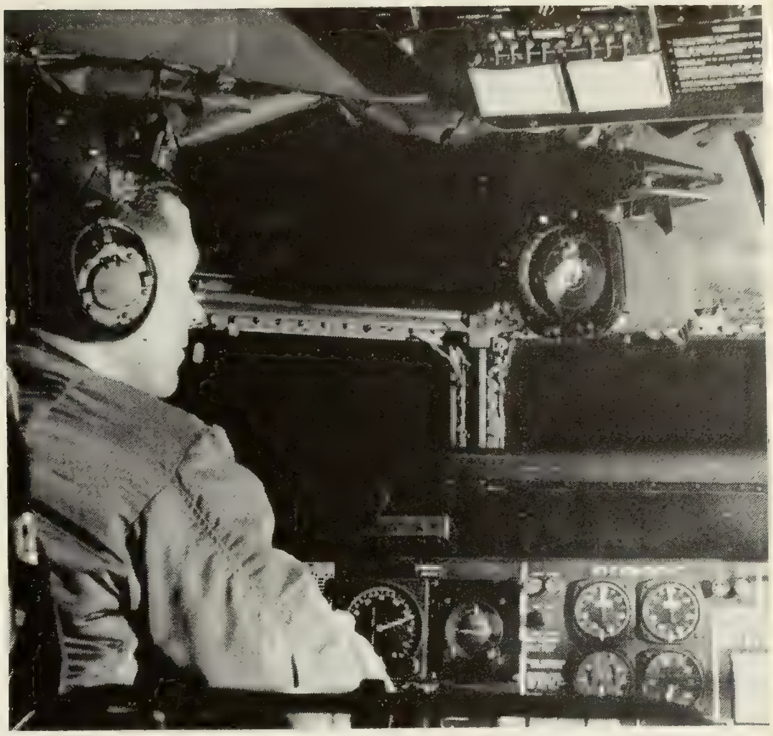
Keep Kurrent

NEWS AND VIEWS

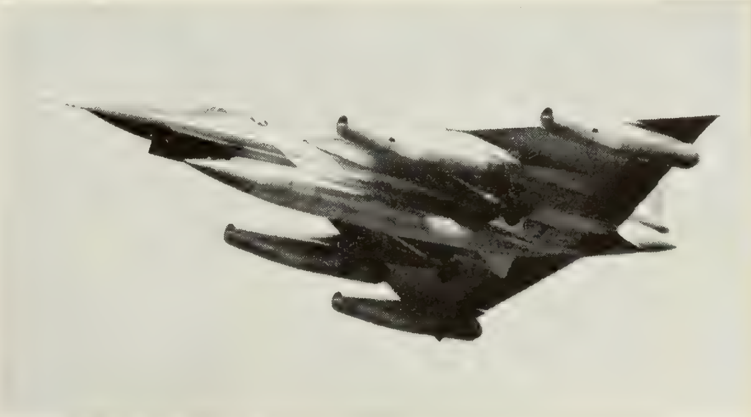
Below, is the first detailed view of the new T-38 supersonic trainer made by Northrop Aircraft, Inc. It features an area rule fuselage.

Captain M. M. Howell, Flying Safety Officer, at Scott AFB, explains the Atkins Anti-Collision Light test project to General Clyde L. Brothers, ATC, Command Surgeon. The light, on this T-33 is on the baggage carrier for evaluation purposes. Normal installation would be on the wing tiptanks. They can be seen for fifty miles.

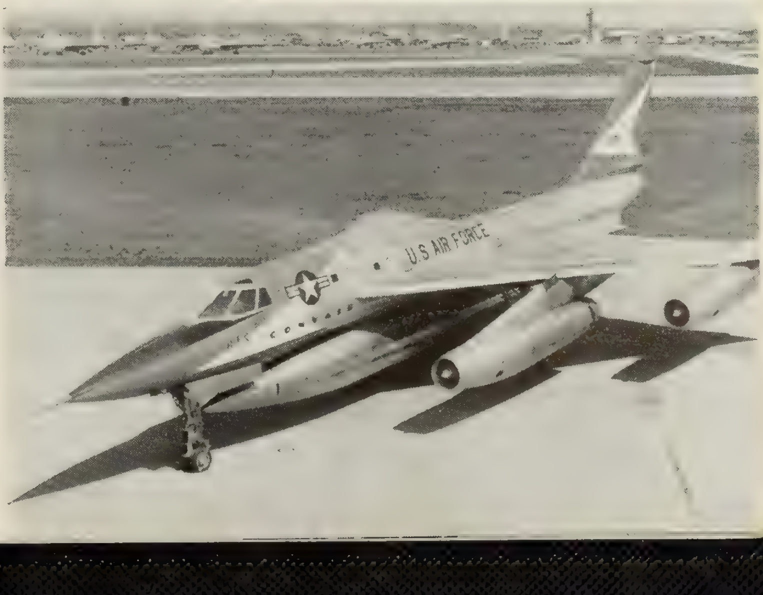




Latest feature of Sperry's APN-59 radar system is a pilot's indicator shown here mounted in the cockpit of a C-97. Like that used by the navigator, the pilot's indicator uses a 5-inch cathode ray tube with excellent viewing of targets located at distances up to 240 miles.



Here are two views of the detachable "pod" carried under the belly of B-58s. The aircraft was designed specifically to carry this store.



SPLASH DEPARTMENT . . . accidents result

An RB-57, returning from an IFR round-robin navigational flight, made a jet penetration and two GCAs. On the go-around from the second GCA, the aircraft passed over the GCA unit at a very low altitude and in a skidding attitude. The pilot advised the tower that he had a fire warning light on the left engine, that he had shut it down, was declaring an emergency and would make a VFR approach. The weather at the time was 1000 feet overcast, visibility seven miles in light rain.

The B-57 turned on final and at an altitude of 200-300 feet the pilot decided to make a 360-degree overhead since he was too hot to land on this approach. The aircraft pitched out with gear and flaps down (still at 200-300 feet altitude); the nose came up gradually, the left wing dropped and began dragging the ground. The B-57 cartwheeled, exploded and disintegrated. Its crewmembers were killed.

Comments:

The investigation and subsequent TDR on the left engine failed to reveal any evidence of an engine fire. The Board determined that the pilot probably had experienced a false fire warning light and had needlessly shut down the left engine. He could have completed a successful landing if he had not attempted a 360-degrees overhead approach with gear and flaps extended from an altitude of 200 to 300 feet. Once committed to land with the garbage out, he would have been better off to have landed hot, and at worst, let the '57 roll through the boondocks off the end of the runway.

■ ■ ■

Approximately one minute after takeoff, a garbled transmission was received by the tower from a B-57 pilot, stating that he had "a . . . warning light and was returning to land." He did not declare an emergency but requested the aid of GCA, since the visibility was two miles in haze and smoke.

GCA painted the aircraft and issued instructions for landing the 46,000-pound B-57 out of an abbreviated pattern. The pilot overshot the turn onto the final approach and was given corrections to bring the aircraft back to the runway centerline. When four miles from touchdown, he was 800 feet low on the glide path. The aircraft continued low and to the left, on the GCA scope, and the pilot was advised to pull up. The '57 crashed two miles from the end of the runway and approximately 2100 feet to the left of the centerline extended. Both crewmembers were fatally injured.

Comments:

A false fire warning light influenced the pilot to return to the base and make an emergency landing with a full fuel load.

The gear, flaps, speed and dive brakes were in the extended position. The Investigating Board believed that the pilot probably attempted to apply additional power to the operating engine when he realized that he was low and short of the runway. The additional power at low airspeed caused the B-57 to roll into the inoperative engine and the aircraft struck the ground in an inverted position. Inspection of the engine failed to reveal any evidence of inflight fire.

The pilot didn't use the correct single-engine procedure; he extended gear, flaps, speed and dive brakes when he didn't have the landing in the bag.

There is no substitute for following the Dash-One procedures under emergency situations.

■ ■ ■

A B-47E, scheduled for a five-hour, round-robin, IFR training mission, departed its midwestern base under weather conditions of 1000 feet broken, 2000 feet overcast, and three miles visibility in light rain and fog. As the aircraft broke ground, the No. 1 engine fire warning light came on. The aircraft commander notified the crew to prepare for possible bailout, then pulled the No. 1 fire button out and placed No. 1 throttle in the idle cut-off position. The fire warning light remained on and the crew bailed out—only 90 seconds after takeoff.

Comments:

An examination of No. 1 and No. 2 engines showed no signs of fire. TDRs were performed, still no signs of fire could be found.

The Board determined that the aircraft commander's decision to abandon the B-47 was premature and that the fire warning light came on because of a malfunctioning fire detection system.

One interesting item—and one which all pilots should know—is that under certain conditions, vapor or condensation will appear in the form of streamers from the trailing edge of the wing and nacelles. This can be, and often is, mistaken for smoke. When this is combined with a glowing fire warning light, it is

from faulty diagnosis

understandable why the crew would be tempted to leave the aircraft.

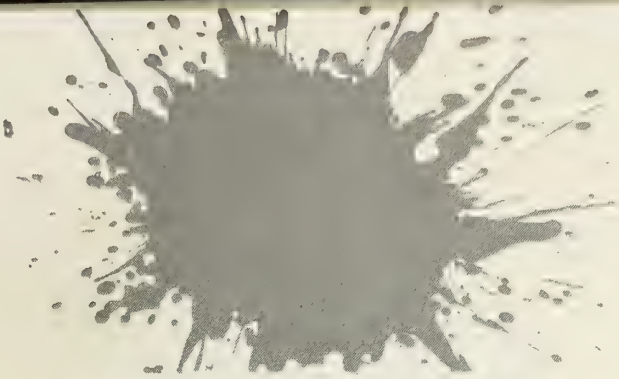
■ ■ ■

During an acrobatic mission, an F-100 pilot started a loop from 15,000 feet, with the throttle at full military power. As he approached the top of the loop, he experienced a severe compressor stall. He pulled the F-100 over the top and as soon as the nose of the aircraft came down through the horizon, the stalls stopped and the engine operated normally.

The pilot started another loop from 18,000 feet and as he passed 60 degrees past the vertical, the F-100 again began a compressor stall. The throttle was left at full military power and the nose pulled down through the horizon. The stalls kept dying away but did not stop entirely. The pilot retarted the throttle and noted the tailpipe temperature was approaching 1000 degrees. He placed the throttle in idle but the stalls continued even though the RPM was only 55 per cent. The emergency fuel system was used and the tailpipe temperature went to 1000 degrees again. Switching back to the normal system failed to remedy the situation and the RPM finally started down below 50 per cent. The pilot notified the tower of his difficulties, then ejected.

Comments:

This accident was attributed to design deficiencies in the F-100A, J-57-7 and J-57-30 engines, and the AJ2-A regulator. However, the investigation brought out the fact that many pilots are uncertain as to what action should be taken when the compressor stalls at the top of a loop. They were in doubt as to whether it would be better to reduce power immediately and chance falling into a spin or leave the power on until over the top of the loop. Many pilots erroneously felt that compressor stalls in the F-100 were not uncommon and that before the engine would overtemp from the stall, it would probably flame out.



Fortunately, modifications have been made on later series aircraft to minimize compressor stalls; however, mechanical devices sometimes fail just when we think a problem has been solved. If possible, considering the circumstances, the throttle should be retarded as soon as the stall occurs. (See story, page 2.)

■ ■ ■

Shortly after takeoff on an IFR ferry flight, the pilot of an RB-66B noticed the cabin pressure fluctuating in a regular rhythmic cycle of about once every 20 to 30 seconds. He checked the cabin window de-fog switch-off and the cockpit pressure switch to normal. When the cabin pressure continued the pulsations, the pilot decided to return to his departure point and have the '66 checked.

The ceiling consisted of high clouds, only; however, the visibility was restricted to five miles in haze and smoke. The pilot made three approaches to the field before he could find the runway because of the bright sunshine and haze.

On the third approach, the B-66 touched down near the 4000-foot runway marker. The drag chute failed to deploy and at the 6000-foot mark, the pilot used the emergency brake system. The left tire blew out at 6400 feet and the right one at 6900. The airplane continued off the runway and the pilot retracted the gear when it appeared that he might run into obstructions off the end of the clear zone.

Comments:

Although the base was above VFR minimums, this pilot should have used GCA, considering the difficulty he had in locating the runway. Further, he continued his landing when it was obvious that he wouldn't touch down in the first third of the runway. He probably relied on the drag chute to counter balance his error in judgment. Although he had four hours of fuel on board, he made no effort to go around.

Oddly enough, the pulsating cabin pressure was believed to have been caused by the wing, empennage and radome anti-icing, de-icing switch being in the de-icing position. The drag chute did not deploy because the actuating handle was not pulled out far enough.

This is another case of incorrect diagnosis of a minor problem which resulted in a costly accident.

Payoff In Performance

Captain Robert H. Jacobson
Experimental Flight Test Pilot School, Edwards AFB.

To better understand the factors affecting the performance of an airplane, you should know some basic aerodynamic theory. Now, don't let the word "theory" flip you. Nearly all aerodynamic phenomenon can be explained in a manner understandable to all pilots. It doesn't have to be mystified by engineers' vernacular and it doesn't have to remain a forbidden realm to you. Familiarity with some of the terms will perhaps make for faster reading, but that's all. For most of us, here is something vital; for the engineer, here's a review.

The drag and performance curves discussed here do not apply to any specific aircraft. But the performance shown applies approximately to a turbojet powered fighter such as an F-84 or F-86 flying at an altitude of 30,000 feet. There are other conditions, such as wind, temperature and aircraft configuration which affect the performance of your bird. These may be investigated later. To do so will require knowledge and understanding of the basis of it all—which lies before you here. Whether or not you make your next destination may depend on how well you know and understand the lesson presented.

HAVE YOU looked at the back of your Dash One recently? Where all those neat little tables used to be, there is now what may appear at first glance to be the doodlings of an idiot. A nightmare, perhaps to some, of curves and graphs that talk of many things heretofore unthought of. Why? Because people didn't need that sort of thing to fly? Some thought they didn't.

Others never dreamed that this was the sort of thing that is the very basis of it all. As airplanes become more complicated, fly higher and faster, the basics become all the more important. What are the basics? Thrust and drag—and their causes.

The terms are not new to you but the fine points that are brought about by them (and which are translated to you on every flight you make) may surprise you. Whip out your trusty pencil and let's analyze.

You've probably heard that the total drag on your aircraft increases as the airspeed increases. This is true for the speeds you fly most of the time. You know this from the fact that a higher power setting is required if you want to fly at a faster

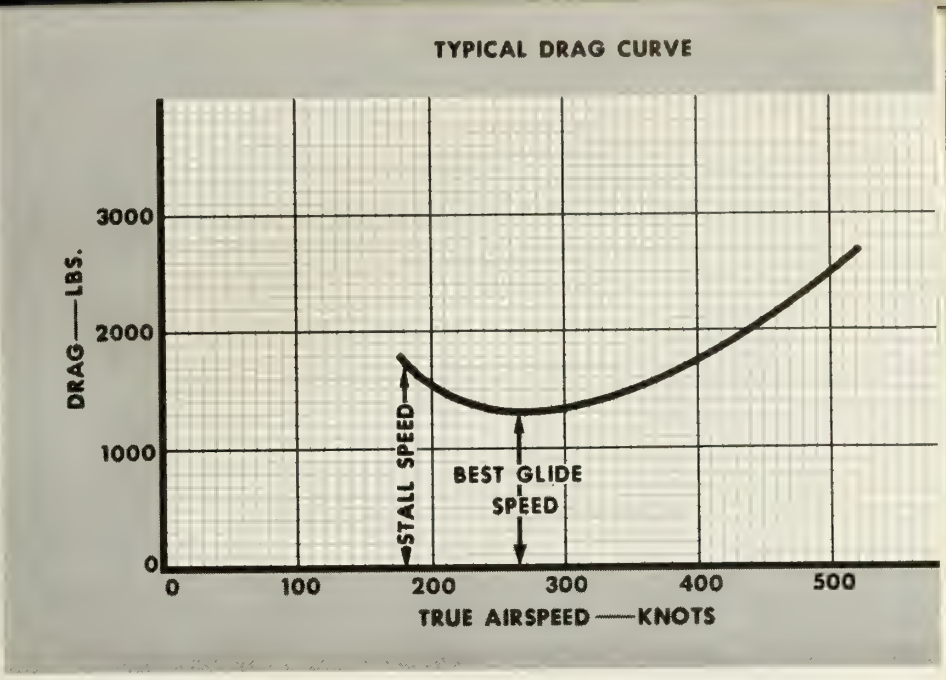


FIGURE ONE

speed. At low airspeeds (from the stalling speed to the recommended best glide speed), the drag decreases as the airspeed is increased. Figure 1 shows a typical drag curve for a range of true airspeeds.

To better understand why the drag curve decreases and then increases as the airspeed increases, take a look at how the parasite drag and induced drag changes with airspeed. The total drag at any airspeed is the sum of the parasite and induced drags. (Figure 2) The induced drag may be explained simply as the drag resulting from lift.

In straight and level flight, the lift is equal to the weight of the airplane. Whenever lift is produced by the wing, some induced drag will result. The magnitude of the induced drag produced by an airplane depends on the attitude or (more correctly) the angle of attack of the airplane and the airspeed.

The angle of attack is the angle between the direction the airplane is pointing and the direction it is moving. Early in pilot training you realized that when flying level at low speeds, the nose was high above the horizon. In other words, the airplane is flying at a large angle of attack, or mushing, as some pilots say. When flying fast, while holding your altitude, the nose is level or even below the horizon, so the airplane is at a small angle of attack.

The different angles of attack for different airspeeds cause the induced drag to be greater at low speeds than at higher speeds. This effect is illustrated on Figure 2. The attitude or angle of attack required depends on the lift produced by the wing (which is equal to the weight in straight and level flight) in addition to the airspeed.

At a given airspeed, a heavy weight airplane flies at a larger angle of attack than lighter airplane. From this you can see that the induced drag depends on the weight of the airplane as well as the airspeed.

The parasite drag is caused primarily by the friction of the air moving over the skin of the airplane. Air actually has an apparent stickiness or viscosity, like molasses, and this property produces a resisting force (parasite drag) to any object moving through the atmosphere.

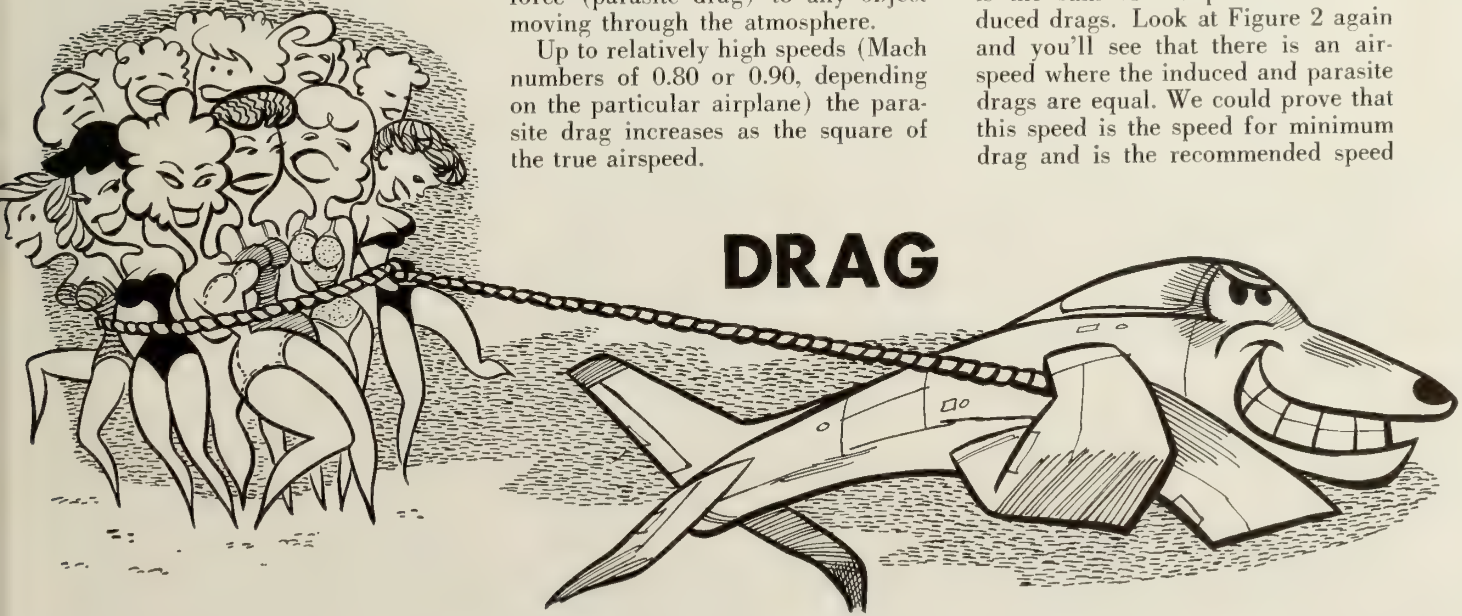
Up to relatively high speeds (Mach numbers of 0.80 or 0.90, depending on the particular airplane) the parasite drag increases as the square of the true airspeed.

$D_p = KV^2$ **(Equation 1)**

Where: D_p = **parasite drag**
V = **True airspeed**
K = **Constant**

The value of the constant (K) depends on the skin area exposed to the air, the roughness of the skin and the density of the air. The variation of parasite drag with airspeed is shown on Figure 2. At speeds corresponding to high Mach numbers, the parasite drag increases at a greater rate than the above equation determines but in this article we are discussing only the lower speeds (below Mach numbers of 0.80 and 0.90). When you go supersonic, there's another way to figure.

As mentioned before, the total drag is the sum of the parasite and induced drags. Look at Figure 2 again and you'll see that there is an airspeed where the induced and parasite drags are equal. We could prove that this speed is the speed for minimum drag and is the recommended speed



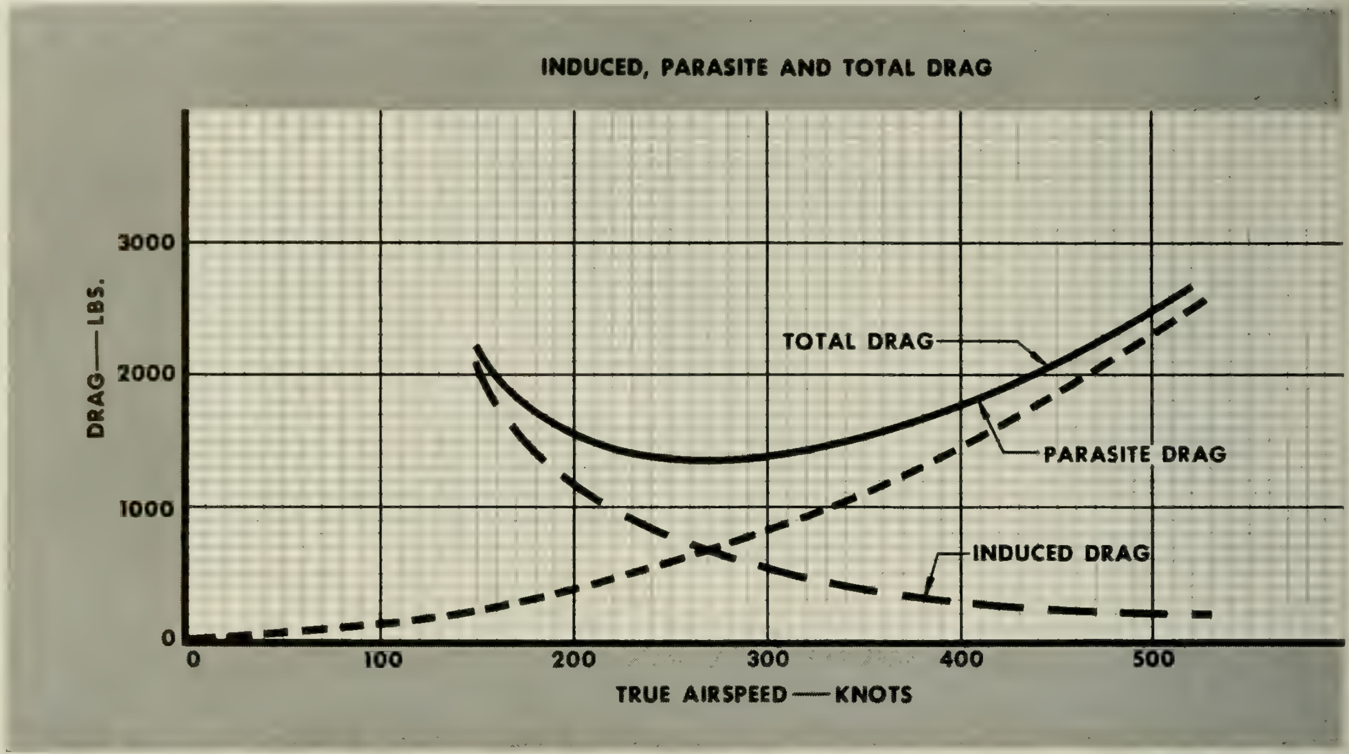


FIGURE TWO

for maximum gliding distance. At low speeds, the induced drag is going to affect you a lot more than the parasite drag so the total is greater than the minimum drag value.

You will find it difficult to fly at these speeds holding the airspeed and altitude constant. This portion of the drag curve is known as the "back side of the drag curve" (or if you prefer, the "back side of the power curve"). At the USAF Experimental Flight Test Pilot School, students are required to determine the thrust necessary to fly at these low airspeeds by experiment.

In the T-33 aircraft, it requires approximately 81 per cent rpm to fly straight and level at 120 kts indicated at 20,000 feet, and only 77 per cent rpm to fly straight and level at 160 kts. So, the existence of back side curve is apparent from flight tests. Try it if you like but watch for the stall. You'll need altitude to recover.

Now let's talk about the effect of the aircraft weight on the drag curves. The parasite drag curve will remain the same. The size of the airplane, skin roughness or viscosity of the air do not change just because the airplane has a heavy load. The induced drag will increase with an increased weight since the required angle of attack is greater. In fact, if the weight is doubled, the induced drag will be four times larger at the same airspeed. This is what makes the total drag for the heavy weight greater than the light weight and it is true at all airspeeds.

A comparison of the induced and total drags for two gross weights is given in Figure 3. Note that as the airspeed increases, the differences between the total drag curves become smaller.

The drag curves, together with the thrust and fuel consumption characteristic of the engine, can predict the range performance of the airplane. Take a turbojet engine operating at 100 per cent rpm. The thrust at this throttle setting remains nearly constant at all airspeeds we're going to discuss. The thrust curve included with our drag curve plots is shown in Figure 4. Note that the drag and 100 per cent rpm thrust curves cross at some speed where the thrust is equal to the drag. This speed is the maximum true airspeed for straight and level flight at 100 per cent rpm. There is a small difference between this speed for the two gross weights.

Now suppose that the airplane is being operated at reduced RPM, such as 90 per cent. A typical thrust curve for 90 per cent rpm is also plotted on Figure 4. The maximum straight and level true airspeed for 90 per cent rpm is indicated by the intersection of the thrust and drag curves. Note that the change in the maximum speeds for 90 per cent rpm between the two weights is much greater than for the 100 per cent rpm speeds.

Specific Range

While cruising, you want to cover the greatest distance over the ground for a given quantity of fuel. Therefore, a measure of the cruise performance is the quantity called "specific range," or "nautical miles per pound of fuel." This is the distance covered while burning one pound of fuel.

The specific range for any airspeed depends on the ground speed and the fuel consumption required to fly at the airspeed. All you have to do to calculate the specific range at any and all airspeeds is to know the corresponding fuel flows.

Remember, we are only discussing turbojet aircraft. The fuel flow of turbojet engines depends primarily on the thrust produced by the engine. At the given RPM the fuel flow decreases as the altitude increases. This is true because the engine delivers less thrust as altitude increases. The

PARASITE...

..orWEIGHT

fuel flow divided by the thrust is known as the specific fuel consumption (SFC). So, once you know the SFC you can figure the fuel flow for a known value of thrust. The SFC of turbojets vary from values of 0.8 to 1.3, depending on the engine model.

Let's take a specific case for example. Let's say that we have zero wind conditions where the ground speed and true airspeed are the same. The equation for specific range is:

$$S.R. = \frac{V_g}{F.F.} \qquad \text{(Equation 2)}$$

Where S.R. = Specific range in nautical miles per pound of fuel.

V_g = Ground speed in knots (same as true airspeed under no wind conditions.)

F.F. = Fuel flow in pounds per hour.

The SFC of a given engine may vary slightly with RPM and airspeed, but let's ignore this variation and assume that it's going to be constant for the sake of simplicity. And to make it more simple, let's use an SFC of 1.0 for this f'rinstance. A specific fuel consumption of 1.0 means simply that the fuel flow is 6000 pounds per hour when the engine is delivering 6000 pounds of thrust. Or, the fuel flow is 2000 pounds per hour when the thrust is 2000 pounds, and so on.

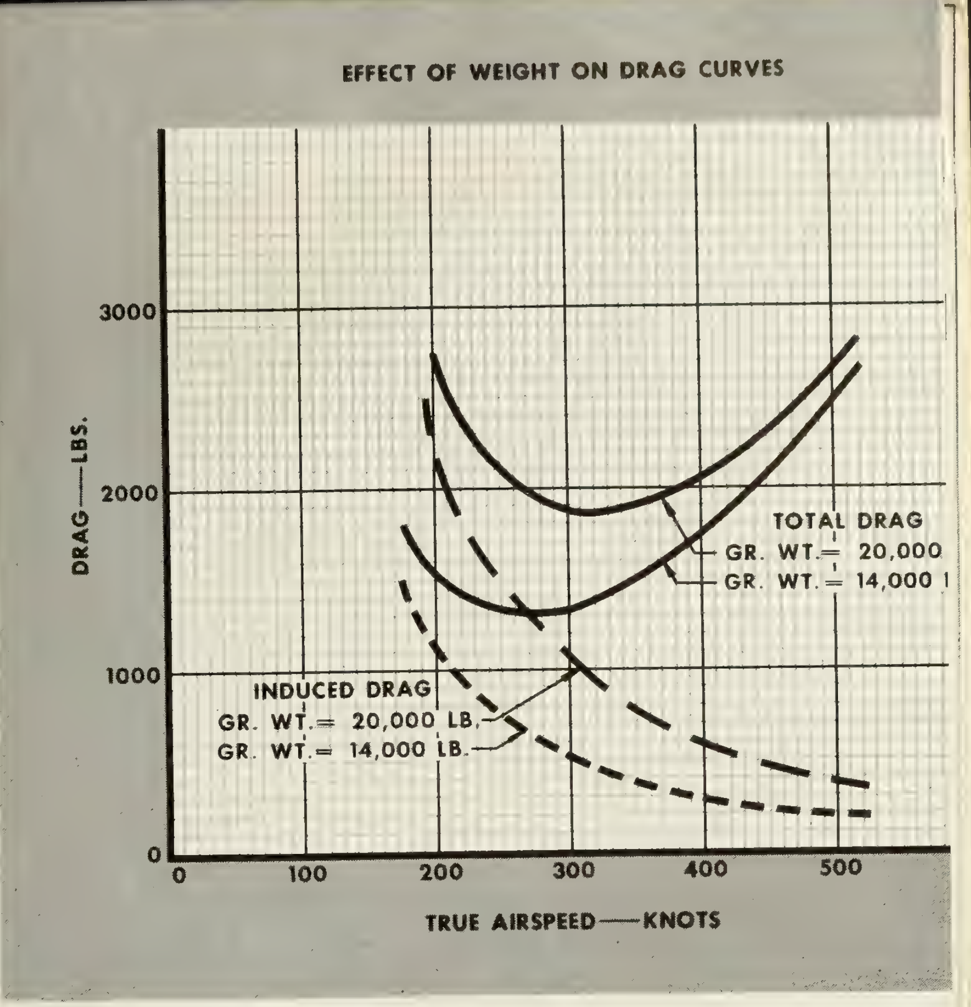
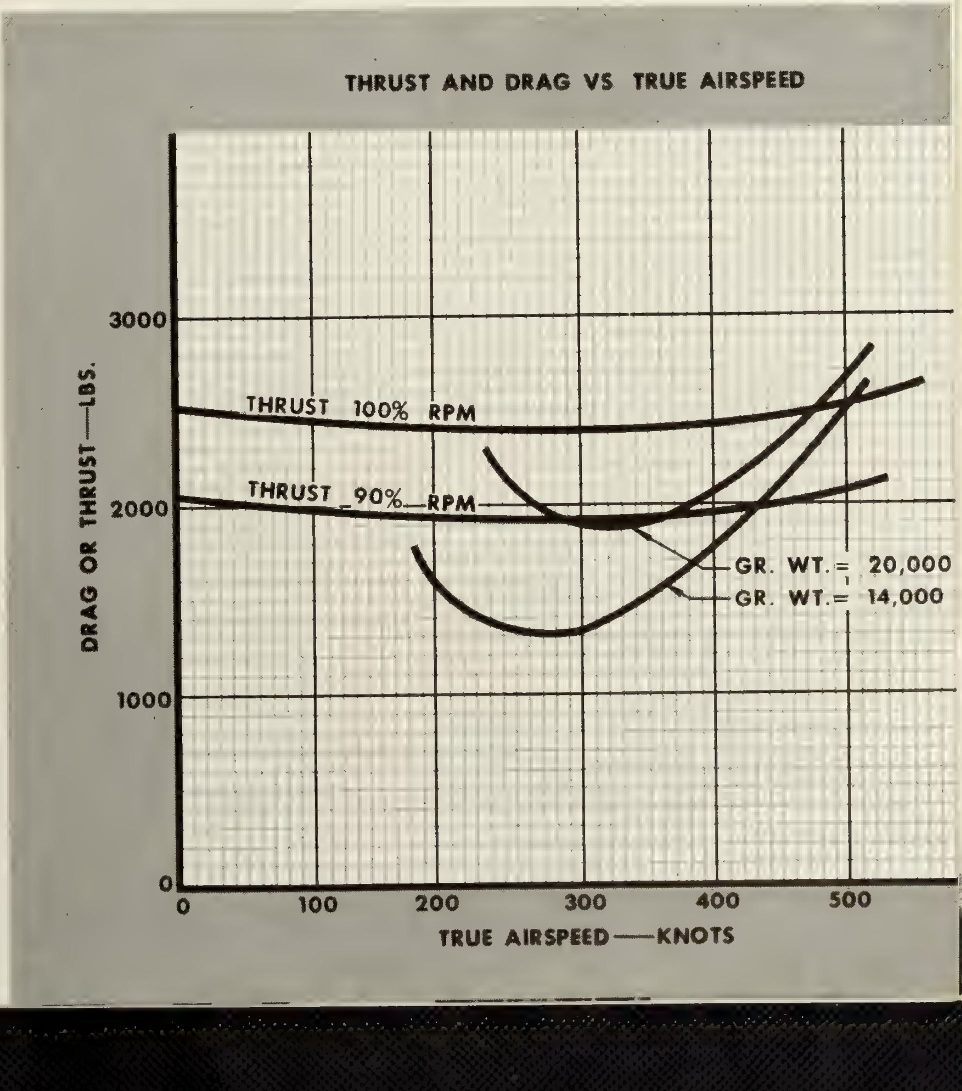


FIGURE THREE

FIGURE FOUR



THRUST DRAG

In straight and level flight at a constant speed, the thrust is equal to the drag. Therefore, if you know the drag characteristics of an airplane and the specific fuel consumption, you can determine the specific range at all airspeeds, gross weights and altitudes. Using specific range you can determine your optimum cruise speed and your best altitude for cruising.

Now that we've looked at these factors separately, let's put them all together. First, let's see what happens to optimum cruise performance at a given altitude, using the same two gross weights we had before and no wind conditions. We will use the same drag curves we were talking about earlier and assume the SFC is still equal to 1.0. Check me on the chart as we go. Figure 4 will work.

At the gross weight of 14,000 pounds the drag at a true airspeed of 320 knots is 1390 pounds. When we move up to a true airspeed of 460 knots, the drag is 2152 pounds. Right? Now, in order to fly at these speeds, the thrust must be equal to the drag. So to fly at 460 knots, you've got to pull 2152 pounds of thrust. Right?

Since the SFC is 1.0, the fuel flow figures to be 1390 pounds per hour and 2152 pounds per hour, respectively. Remember Equation 2? Let's put in our figures and crank. Now, if simple arithmetic doesn't throw us, the specific range can be easily calculated. And you have some usable data.

For $V_t = 320$ kts:

$$\text{S.R.} = \frac{320}{1390} = 0.230 \text{N.M./lb}$$

For $V_t = 460$ kts:

$$\text{S.R.} = \frac{460}{2152} = 0.2136 \text{N.M./lb}$$

When these specific range figures are plotted on a graph of specific range versus true airspeed along with additional points for other airspeeds, a curve may be drawn. This curve is shown on Figure 5. Look at it for a second and you will see that the peak of the curve represents the speed for optimum cruise. And, you can read off the value of the maximum specific range directly from the curve.

Best Cruise

What does all this mean to Joe Glotz, Pilot? Just that he has to know the specific range value to determine the quantity of fuel he's going to consume in flying a given distance. So it is necessary for flight planning. In order to simplify flight planning, the best cruise calibrated airspeed which will give the best cruise true airspeed is presented in Appendix I of the Flight Handbook —the Dash One.

Now do these curves look familiar? They should. They're the same types that you look at every time you plan a flight. And now you know why they look that way.

The specific range for the gross weight of 20,000 pounds is calculated in the same manner. A table showing the quantities used in the calculations are shown below.

V_t Kts	Drag	Fuel Flow	S.R.
280	1928 lb	1928 lb/hr	.1452 N.M./lb
320	1864 lb	1864 lb/hr	.1716 N.M./lb
360	1917 lb	1917 lb/hr	.1878 N.M./lb
400	2054 lb	2054 lb/hr	.1946 N.M./lb
460	2381 lb	2381 lb/hr	.1932 N.M./lb

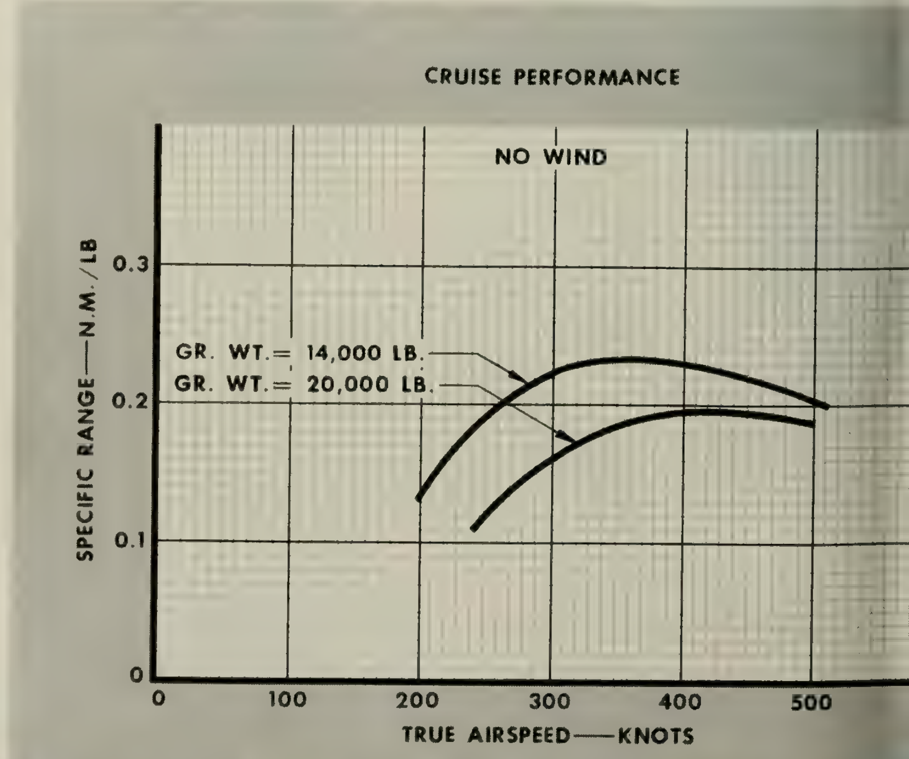
These values also are plotted on Figure 5, along with the curve for the gross weight of 14,000 pounds.

To compare these curves two important facts should be obvious.

First, the cruise performance for the light gross weight is far superior to the heavy weight cruise performance. Compare the optimum specific range to determine the effect of weight on cruise performance.

The second fact is that the true airspeed for optimum cruise decreases as the weight decreases. This means that you should fly a lower calibrated airspeed as fuel is consumed in order to remain at the best

FIGURE FIVE



cruise conditions. But remember, we are comparing cruise performance at a constant altitude. We have not talked about the effects of altitude. Take another look at the curves of Figure 5. Notice that the curves are quite flat in the vicinity of the speeds for maximum specific range. What will happen if you cruise at a speed faster than the speed for maximum specific range? Your total range will be reduced but your average speed will be increased. So, the duration of the flight will be reduced. From Figure 5 you can see that your maximum specific range for 14,000 pounds is 0.233 nautical miles per pound of fuel. But you can achieve this specific range only if you fly at a true airspeed of 360 knots.

Now what will happen (in terms of airspeed) if you decrease the specific range? Look at Figure 6. The curve is a portion of the specific curve for the 14,000-pound airplane we were working with in Figure 5. Point A, on Figure 6, is the maximum specific range value. If you are willing to sacrifice one per cent of your range you can fly at a higher speed.

Just One Per Cent

The specific range only one per cent less than the maximum is .231 nautical miles per pound. The curve on Figure 6 gives this specific range value at point B. The speed for point B is 396 knots. Therefore, only a one per cent drop in specific range provides an increase of 36 knots in airspeed for this example. This higher speed (point B) is called the "recommended cruise speed" that you see listed in the Appendix to the Flight Handbook for your aircraft.

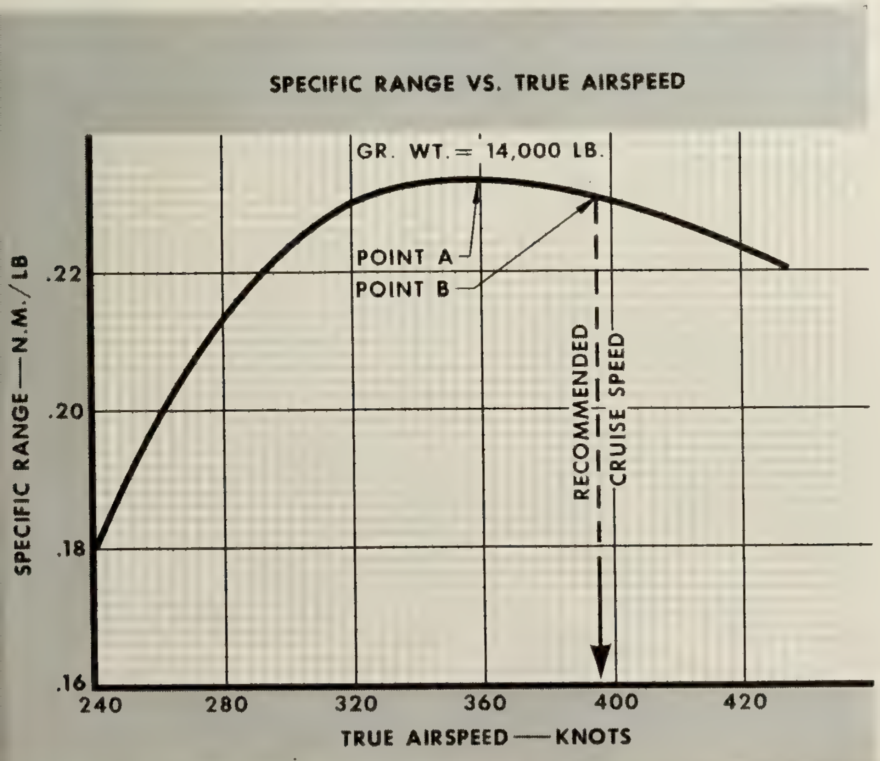
You will notice that the latest editions of the appendix contain the specific range curves for various altitudes and gross weights. The T-33 cruise data in the appendix to the Flight Handbook are a good example of these curves. The specific range is plotted against calibrated airspeed in the Dash One. The corresponding true airspeed scale for standard temperature condition is shown on the bottom of each cruise data page.

Looking at the T-33 cruise data, you'll notice that a change in the gross weight has much more effect on the cruise performance at high altitudes than at low altitudes. The recommended cruise speeds are slower for the lighter gross weights than for the heavier gross weights. The specific range curves in the Flight Handbooks also indicate the power settings and fuel flows for the various airspeeds.

The cruise curves are obtained from calculations based on the drag and engine characteristics determined from flight tests unless they are indicated as estimated data. The curves apply directly to zero wind and standard temperature conditions.

What happens when the wind goes up and temperatures are somewhat other than "standard"? That's for another day. These are the essentials; the very basis of it all. ▲

FIGURE SIX



ABOUT ABORTS

WHICH?

Captain Harry J. Tyndale
666th AC&W Sq, Mill Valley AF Sta. Calif.

There are "line speed checks" and "Line Speed Checks." The ones that really work are those which have been carefully worked out. The "working out" is next to impossible until you know what you are doing and how the whole thing comes about. FLYING SAFETY (August 1956) explained the mechanics of the "working out." In the following article we explain some of the "whys" behind the operation and tell the tale of how a real sharpie used them to his advantage. We highly recommend another look at the August 1956 issue. The charts illustrating that article are reprinted in this one.

CAPTAIN Johnson, the local Flying Safety Officer, was sipping his first beer at the Friday evening get-to-gether. He was casually aware of a deep discussion among a group of fighter pilots next to him. Suddenly one voice rose abruptly in pitch and, in firm tones, said: "Now look, Buster, I don't care how much calculating you do, you can't convince me that you can make a sound decision when you've hardly even begun to roll."

"Sir," a gentle but determined voice answered, "The facts involved in my decision are verified in the Dash One. Furthermore, an article published in FLYING SAFETY about a year ago specifically endorses the procedures which I used."

Nothing else needed to be said to clarify the discussion. Captain Johnson had already heard that a new man had ripped his knickers by aborting at the 4000-foot mark. The remarks made around the Group that afternoon had caught his ear. The squadron commander seemed to think that this might be an early case of fear of flying. It seems that the pilot wrote the bird up for insufficient thrust, although he also noted that the RPM and TPT were normal. Both maintenance and pilot personnel felt that he had not only goofed but signed a written confession. There were many of those sheepish smiles and shrugged shoulders in evidence during the afternoon.

Recalling how the computation of refusal speeds had befuddled him at USC's FSO course, Captain Johnson could not resist the urge to crash the conversation. As he moved in, he immediately recognized the victim as Lieutenant Lovitt, a mild-mannered, aeronautical graduate, with whom he'd had an interesting discussion about a recent takeoff catastrophe. "Hi, Phil," he said to Captain Wright, the Ops Officer. "I heard a little about this deal today and I'd like to buy in—for what my opinion's worth."

"Oh, very well," answered Captain Wright, "but let's go over to the table and sit down."

The large corner table was not quite big enough. Pilots were two deep in places. The Squadron Commander arrived during the shuffling of chairs and was accorded the courtesy of ringside.

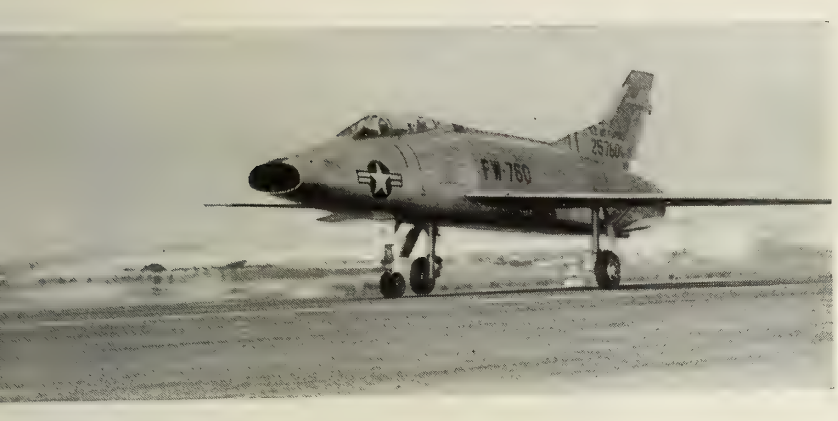
Captain Johnson took the initiative and suggested that since Lieutenant Lovitt was the man with the facts, he start by telling what he had done and why.

"All right, sir," Lieut. Lovitt began, "this was a pre-briefed mission. I was up for the second ride in 625. Lieut. Thrall was the pilot for the first mission. The Commander specified the use of a 175 so I went down to base ops to plan the flight. I got there early and had to delay the weather entry so that it would hold up through takeoff time. This gave me plenty of time to doodle so I cased the runway distance problem completely. The file of Flying Safety Magazines was handy so I reviewed the article "Runway Check Point," published in the August 1956 issue.

"The forecaster said that the current runway temperature was 93° F. I was told to expect a one-degree rise per hour, to a peak of 98 at 1500 hours. I selected 95 as my best probability. The charts indicated my ground roll to be about 7250 feet. I made a rough calculation for halfways speed (the speed I expected to have in the first half of my computed ground roll). I reduced this by 10 per cent for nerves and came up with a figure of 97 knots. When I hit the 4000-foot runway marker, I only had 98. The RPM and TPT had been right on the button so I chopped it."

Captain Johnson had been watching the expressions carefully. He concluded that he'd better keep control of the discussion. It was obvious that the boys weren't very impressed with the procedures. "Sounds like a pretty good decision to me," he said, to avoid an interruption. "Suppose we take a closer look at it to see if your actions were overly cautious." There was a slight rustling as the group settled into the chairs for what promised to be a typical Johnson analysis.

"You say that the chart called for 7250 feet ground roll. Then, you said that you calculated a halfway speed



for that roll. Would you explain that to us, please?

"Yes, sir," began Lieut. Lovitt, "Since the acceleration of a jet doesn't drop off rapidly until you get up to speeds above 100 knots, it is easy to figure the speed you should have at an early point in the roll."

"Whoa!", interrupted Captain Wright, "I've heard that the power of a jet goes up directly with the speed increase. That should certainly give a better rate of acceleration at higher speeds."

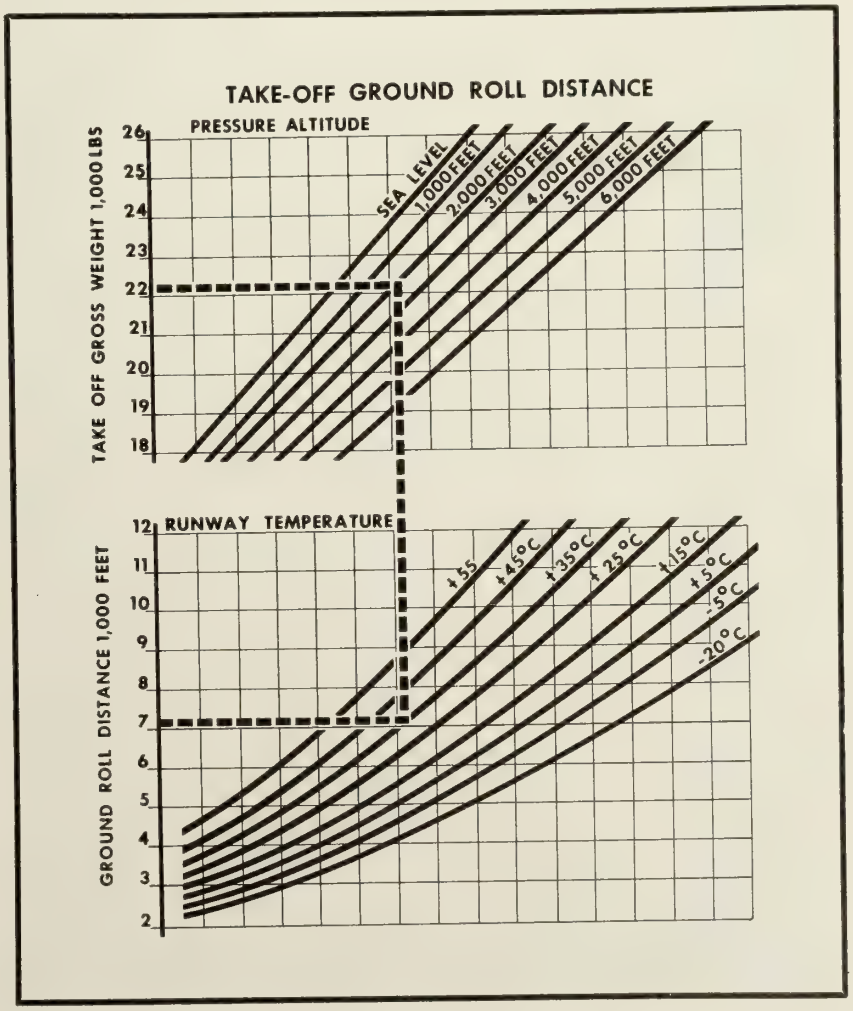
"That's good logic, sir, but it isn't so. You accelerate on thrust, *not* power. Power is a measurement of the work being done. The power does rise with speed but the term refers to the amount of work done in moving the aircraft to some speed in the particular length of time.

"The term 'horsepower' is applied to jets only as a comparison. Thrust is the force that pushes the bird, and thrust in a jet remains relatively constant regardless of speed. Essentially, a constant push, against a steady resistance, will yield a continuous increase in speed, up to the point where increased resistance creates a state of balance. In our business, the increased resistance comes in the form of drag.

"The actual rate of acceleration is governed by the thrust/weight ratio. The presence of drag must be considered, of course. For this reason it is convenient to formulate rules of thumb in the region of operation where drag is relatively low. "For purposes of discussion, let's assume that our aircraft has an average early rate of acceleration of 4.8 ft./sec /sec. This comes to just under three knots per second. It would take about 55 seconds to reach 264 ft./sec., which is unstick speed of 158 knots for our theoretical aircraft. To understand the reason for selecting the halfway mark of your computed takeoff roll for decision, you must visualize the relationship of runway used, versus speed gained.

"In the first second after brake release, you go from zero to 4.8 ft./sec. Your average speed for the first second is 2.4 so you used 2.4 feet of runway to gain your first three knots.

"Now look, Buster, you can't convince me."



Now, look at the top end. If you had constant acceleration, after 50 seconds you enter the 51st second with a speed of 144 knots which is 240 ft./sec. The average speed during this 51st second will be 242.4 ft./sec. So you will use 242.4 feet of concrete to gain the same amount of speed that you get for only 2½ feet in the first second. It is this relationship which explains the fact that you get 70 per cent of the speed in 50 per cent of the run. Actually, the acceleration decreases as the speed goes up so the difference of runway used per knot of speed increase would be even greater.

"If you consider the fact that stopping distance is affected in exactly the same way (70 per cent of the deceleration takes place in the last half), you can see that each second of indecision can cost 400 to 500 feet of runway. At the high end, each second means 240 feet used to gain three knots and 200 or more required to get rid of it if you decide to abort. These are the reasons why I choose to use the halfway mark as my checkpoint."

Since this sounded like termination, Captain Wright posed a question.

"This sounds sensible for us, but what's wrong with using the published distance on other types of aircraft?"

"Two things, Captain Wright. First of all, few bases have enough runway to allow for a rise to takeoff speed, a decision and retard and a safe stop. Furthermore, an abort is seldom associated with a bird that is performing up to snuff. Unsatisfactory acceleration is often the trouble and that is the very thing that uses too much runway for too little speed."

"That's why we emphasize distance instead of speed," offered Captain Wright.

"Yes, sir," answered Lieut. Lovitt, "and in principle, that's good. The only trouble with that theory is that the published distance assumes test pilot technique." (Lieut. Lovitt noticed the raised eyebrows, so he continued.) "I said before that the drag increases slowly in the early stages of roll. When you raise the nosewheel, the aerodynamic drag which accompanies high angle of attack enters the picture.

"This is the item that separates the men from the boys. Many are the men whose status was reduced by an embarrassing stop on the rocky overrun.

"My point is: Since technique is a factor here, and it varies widely, why not plan it right out of the picture? The speed for nosewheel liftoff is usually above 70 per cent of unstick speed. Therefore, the human element doesn't enter the picture during the first half of the roll.

"At this speed there is always enough runway to allow for a delayed decision and a safe stop. Even with a minor airplane or pilot malfunction, why throw all this gravy away just to confirm that your thrust is low?"

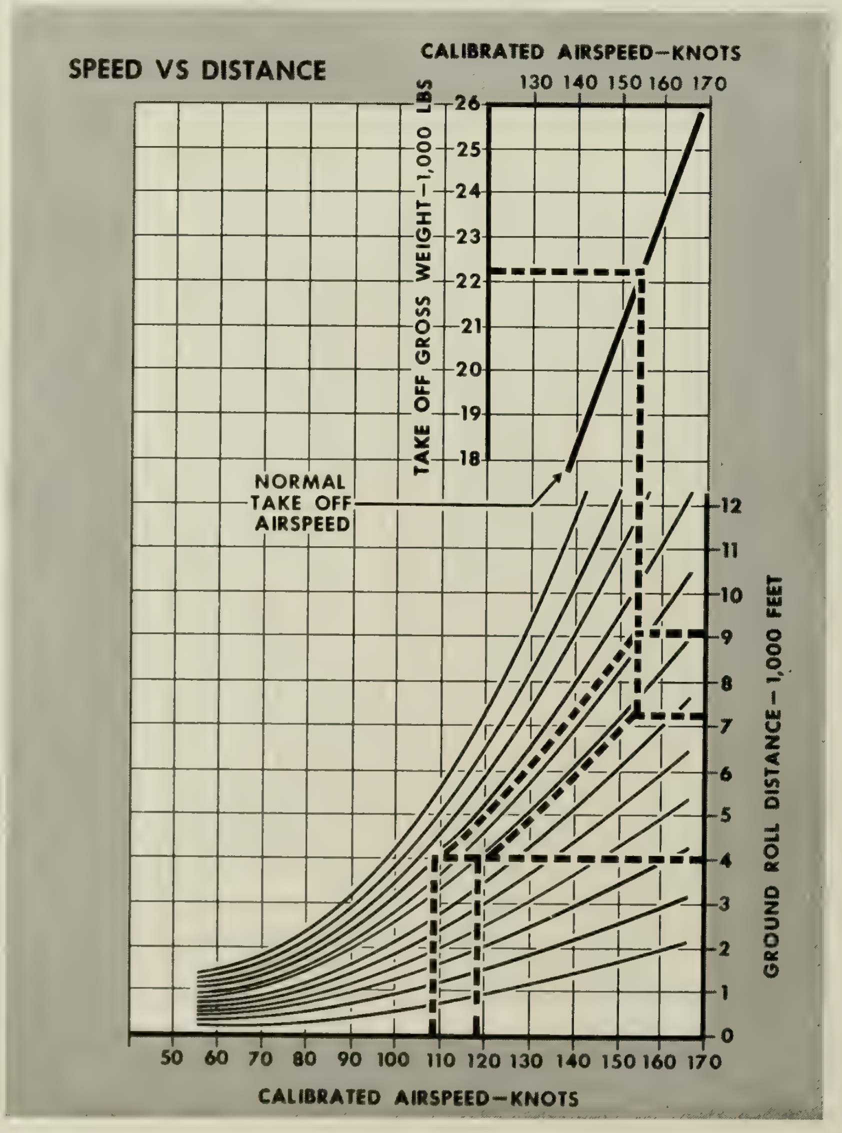
Captain Johnson grasped this opening. "You said that you drew your abort line at 10 per cent under calculated speed. Would you explain that, please?"

"Yes, sir, I will. A 10 per cent discrepancy at ⅔ of speed at least a 15 per cent shortage later. In any airplane it would take 30 per cent more runway to get 15 per cent more speed. The amount of shortage you can accept is governed by the amount of extra runway you have available. In my case today, 30 per cent of 7250 is 2175, for a total requirement of 9425 feet. And, this is the most optimistic picture!

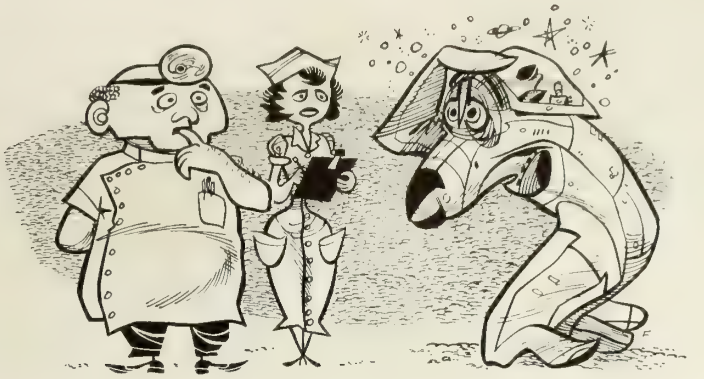
"Frankly, I don't intend to prove anything of this nature in an airplane. When the facts of Physics cast doubt upon a situation, I choose to confirm my decisions in the hangar. I don't intend to debate my case with the members of the accident investigating board."

The utter silence did not surprise Captain Johnson. He thought it very appropriate that the commander broke the silence.

"That airplane will get a full checkup in the morning, Lieut. Lovitt. Meanwhile, the next round is mine." ▲



What's Your Trouble?



HOW WOULD YOU turn an emergency or even a minor malfunction of equipment into an aircraft accident?

It's easy. All you have to do is incorrectly diagnose the trouble; fail to follow the Dash One procedures or make one wrong decision and you have the stage all set.

Perhaps you would like to have some examples. Here are a few from the records on file.

An F-86F pilot experienced partial power failure while returning from a local mission. The RPM dropped to 22 per cent and the tailpipe temperature decreased to 250 degrees. He decided that he had flamed out so he stop-cocked the throttle. When he attempted an airstart, he could still get only 22 per cent rpm and 250 degrees egt. Since he was very close to the air base at the high key altitude, he stop-cocked the throttle again and made a flameout landing without further incident.

What was his trouble? The main fuel regulator had malfunctioned and regardless of throttle movement, 22 per cent rpm was all that the engine would produce on the amount of fuel it received from the regulator. The emergency fuel system functioned perfectly on the post-flight check, but the pilot had made no effort to use it during the so-called emergency. The pilot should have known that he did *not* have a flameout because he had tailpipe temperature. Possibly he was influenced by being over a 10,000-foot runway, but regardless of how proficient you are, shooting a landing while flamed out is doing it the hard way. If this pilot had switched to the emergency fuel system, he would have had normal power.

Three T-33 accidents occurred within the same week when flameouts were caused by fuel regulator troubles. In each case, several automatic airstarts were attempted, without success. None of the pilots tried a manual airstart. Subsequent investigation revealed that the emergency fuel systems operated satisfactorily and manual airstarts probably could have been accomplished. In two of the three instances, a faulty Cook pressure switch failed to alert the emergency fuel system when the take-off-and-land switch was turned on. It was believed that a malfunctioning auto-start fuel sequence switch accounted for the third T-Bird's failure to airstart on the automatic system. Three airplanes were lost from poor troubleshooting.

At a southern air base, many false fire warning lights were experienced after three consecutive days of rain. It was well known that moisture was shorting the fire warning system and pilots were briefed on this item; however, one pilot didn't get the word and on his next flight the red light came on. This boy didn't use all the recommended methods for determining if he really did have a fire. He merely retarded the throttle to idle and when the light didn't go out, he ejected. Inspection of the engine, accessories and tailpipe failed to show evidence of an inflight fire.

A B-57 pilot on a night navigation mission noticed that the fuel flow indicator needle on one engine was fluctuating slightly. He assumed that something was wrong with the main fuel system and decided to go to the emergency system. Carefully throttling back to a lower RPM, he unintentionally flipped the emergency fuel switch on the opposite engine which was operating at high RPM. Needless to say, sheets of flame shot from the engine. It oversped, the tailpipe temperature hit the peg and things in general were not good. The pilot then actuated the wrong fuel shut-off valve and—finding himself with no engines operating—ejected!

After many days of investigation, the Board determined that the small amount of fluctuation in the fuel flow meter was not abnormal for the B-57 and that the pilot had brought his troubles on himself.

The files show far too many poor decisions which have resulted in mishaps by pilots who failed to analyze their difficulties correctly. Mistaking condensation from the pressurization vents for smoke has led more than one pilot to jettison his canopy, dump the cabin pressure or even abort the mission (sometimes upping the gear) when he actually believed he had a cockpit fire.

Of course, the records also contain many reports of commendable feats of airmanship performed by pilots who diagnosed their problems correctly.

Taking off under IFR conditions on a cross-country flight, one pilot was unable to contact any ground station. He could receive all right but couldn't transmit. He finally determined that he had a broken wire in his oxygen mask microphone. Using the tone button on the channel selector box, he transmitted an SOS in the blind. CAA ground stations picked it up, alerted their net and also Flight Service, and the fighter was worked all the way to its destination with advisories.

Obviously, there are times when a pilot will not have time to sit and think about what is happening to him. There are occasions when he must get out of the airplane in great haste, such as in structural failures, fires and explosions, mid-air collisions and the like. However, when time permits, every pilot must know his equipment to such an extent that he can properly determine *what* is happening, *why* it is happening and what he can do about it.

Every known procedure must be used to isolate failures or determine conditions prior to making the decision to get out or crash land. Not only will you save an aircraft, you may also save your life. ▲

Here is an Engineer's approach to an inflight problem. The key, as always, is a thorough understanding thereof. The Dash-One for your bird will give the procedure. You apply the basic knowledge. Without a complete mixing of the two, you may only furnish—

...Fuel for Fire

Lt. Col. John A. Robertson
Engr. Br., Research & Analysis Div., D

FIRE FROM THE burning B-25 still lighted the runway where the aircraft had burst into flames on an emergency landing. Major Hardy, the pilot who had brought it in, watched firemen busily bringing the fire under control from a point where he and his companion, Lieutenant Corwin, had run after hastily leaving the plane. He turned to the Lieutenant and exclaimed: "Boy, are we lucky that engine fire waited 'til we landed instead of happening in the air!"

"You are so right," Lt. Corwin gratefully agreed. After a slight pause he added, "You know, I used to have a commander who always said that accidents don't just happen. He said they are caused."

"Well, then I guess in his book, I'd be court-martialed for arson," Major Hardy shot back, "but there's a burning B-25 that I don't remember putting a torch to. . . ."

Even as he answered, Major Hardy's mind was weighing the possibility that this fire hadn't "just happened." His words faltered momentarily and then he continued, "Now that you bring up that angle, I remember reading a fire-prevention procedure that's trying to come through to me. I think it's in the Dash One Handbook. Let's go on over to base ops, get some coffee, and hash this operation out from shortly after takeoff when you mentioned a strong smell of fuel. We'll see if we "caused" this accident or if it just happened.

They settled themselves at a table and Lt. Corwin began, "Right after takeoff I smelled the stuff and we immediately spotted fuel running out of the right nacelle. We had normal fuel pressure and the engines were running okay at climb power. Then you called the field and declared an emergency."

"Yeah, then on the final approach," Major Hardy interrupted to carry on the story, "I pulled the throttle back just as we touched down, and Blooey! The whole right wing was covered with fire. I cut the master switch and—wait a minute! That thing let go when I pulled the throttle back."

Major Hardy paused and repeated, "When I pulled the throttle back." He seemed appalled at the dawning realization that he had caused an accident. He continued woefully, "I might as well have put a torch to the thing."

Answering the puzzled look on Lt. Corwin's face, he explained, "I set fire to the leaking fuel with the exhaust flame when I reduced the propeller slip stream velocity . . . and to think I don't let my son play with matches."

"I'm not receiving you. You're coming in garbled," Lt. Corwin broke in on the monologue. "What's all this 'slipstream velocity' business? And just what did you have to do with that? As far as I can see, you recognized an engine fire hazard, called the tower, declared an emergency and brought 'er right back in. So the engine starts to burn on landing. We got out alive. What else do you want?"

Major Hardy took an envelope out of his pocket and started pencil-sketching the story on the back of it. He drew a nacelle, prop and exhaust. Pointing to the nacelle, he said: "We begin here," and printed out FUEL LEAK in the area of the carburetor.

Major Hardy continued, "Now when this leaking fuel becomes vaporized and mixed with air, it is combustible. Check?"

"Check. So why doesn't the fire start immediately?" Lt. Corwin wanted to know. "The exhaust flames are there, ready and able to set it off, aren't they?

"Right you are. BUT."

"Yes, BUT?"

"It's like this," Major Hardy explained. "While we are carrying power on the engine, the slipstream velocity carrying the leaking fuel vapors back past the exhaust stack outlet is faster than the free airstream flame front propagation speed."

"Say it again and this time make it simple," Lt. Corwin urged.

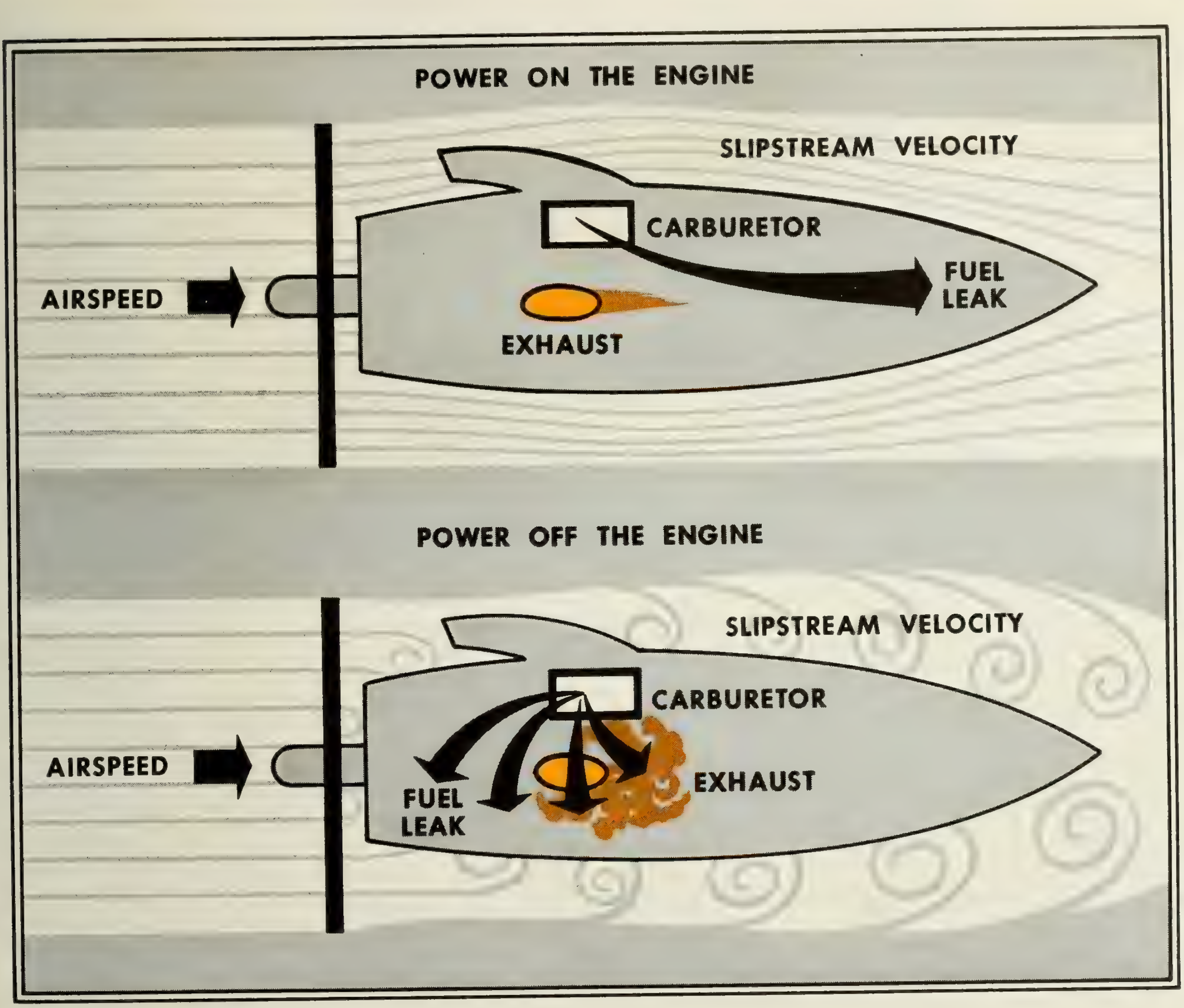
Major Hardy smiled and said, "Okay. Let's make a comparison: If a fish capable of swimming 30 miles an hour is trying to go upstream against a current that is coming down at 100 mph, the fish isn't going anywhere—but backwards. Right? So back to the plane. The flame front propagation velocity is the fish that can't move forward and the slipstream velocity is the water current that is holding it back. The fish can't travel against those odds, and the flame front can't either. Are you still with me?"

"So far," Lt. Corwin nodded. "Proceed."

"If I put that same 30 mph fish in water which is coming downstream at 10 mph, there isn't anything to keep him from heading upstream for home. Similarly, if I reduce power I slow down the slipstream enough to let the then faster flame front (like that fish) head for home." Major Hardy put the finishing touches to his sketch of the problem and concluded: "You see, I could have prevented this major accident and avoided being an arsonist."

"Now, let's not get hasty with incriminating names," Lt. Corwin remonstrated. "I understand why we got the fire when you pulled the throttle but we had to land. I don't understand how you think you could have avoided that. Just how do you figure you could have stopped this bonfire?"

"Simplest thing is the world," the Major assured him. "First, I should have LEFT THAT THROTTLE ALONE and carried cruise power all



the way down the final approach until we touched down, and then cut the engine off by moving the mixture control to idle cutoff."

"I get it," Lt. Corwin's eyes brightened as he completed his own explanation. "You eliminate the exhaust flame, then it doesn't matter whether the slipstream velocity is fast or slow. There is nothing there to set fire to the combustible vapors."

He got about half way out of his chair, assuming that the discussion was closed, when another thought crossed his mind. He sat down and asked: "Just suppose, Major, that we are already at considerable altitude, cruising along, fat, dumb and happy, and the same fuel line breaks. What then?"

Major Hardy responded, "I wondered when that possibility would occur to you. Although you might say it's a horse of another color, it's still a horse. It's a "horse" whether it's a B-25 or any other propeller-driven airplane. This same fuel leak situation can arise on takeoff, landing or—as you have brought up—cruising. The cruising "horse" merely requires slightly different reining procedures."

"Such as?" Lt. Corwin prompted.

"We begin the same way, but not doing something. Would you care to hazard a guess as to what we do not do?"

"Yes, sir!" We DO NOT TOUCH THE THROTTLE. Then what?"

"Then we move the mixture control to idle cutoff."

"I'm right with you," the Lieutenant joined in. "Then we feather?"

"Roger," Major Hardy concluded. "Same problem; same solution."

"You know, sir, it strikes me that any time a malfunction—fuel leak, oil leak or otherwise—requires cutting an engine in flight, the same preventive measures would apply."

"Again, Lieut. Corwin," Major Hardy agreed, "Same problem; same solution."

Major Hardy glanced across the room at another officer approaching them and invited Lt. Corwin. "Here comes the Accident Investigator. And this is one instance where your old commander was right. This accident didn't—"just happen." ▲

CROSS FEED

LETTERS TO THE EDITOR

NCOs in ATC

I have worked in the control tower, Military Flight Service and Base Ops for the past eight years so I found your article "Flying Safety on the Airways" most comprehensive. The information presented therein is informative to enlisted personnel in the air traffic control field as well as to those who do the flying. Articles of this nature should be more frequent since they give an insight into the magnitude of the daily problems confronting the behind-the-scenes personnel; the day-to-day, 'round-the-clock guardians of the airways. Thanks for an indirect pat on the back to those people.

T/Sgt Darwin A. Whitehead
AF Tech. Adv. Mass. ANG

Sarge, it's nice of you to write us. Tentative plans are in the mill to reprint the article under separate cover to meet the great demand from our readers.

■ ■ ■

Wives Help

The 3d Air Transportation Squadron has come up with a novel innovation of the fly-safe program. The Flying Safety Officer has written a letter to the wives of crewmembers about the contributions made by them to their husbands' efficiency. He wrote them about the importance of proper diet, rest and recreation necessary for a healthy physical and mental outlook, thus making those husbands fit to perform the duties and responsibilities demanded.

Then he discussed the need for an effective flying safety program and placed particular emphasis on crewmembers' attendance at weekly flying safety meetings.

Regarding those meetings, part of his letter is quoted:

". . . . Strange as it may seem, we seldom have the opportunity to learn of the hair-raising stories which you probably hear about your husband's last flight. During his next discourse of 'parlor flying,' why don't you remind him to relate his tale during the flying safety meeting so that other airmen can benefit from his experience? By working it this way we can analyze errors, while he can help us prevent making the same ones again."

And with his thanks, he signed it

Your Safety Officer."

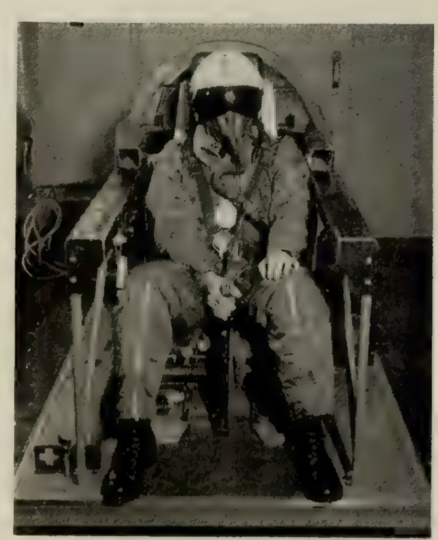
Quite often their help goes unnoticed, but really the Gals do a lot toward helping you to be an efficient crewmember.

■ ■ ■

Another Bailout Trainer

Your December issue contains an interesting picture of a bailout trainer and an interesting letter by Captain James McMullen.

We, of this unit, thought some of your T-33 bases would be interested in our trainer which was specially built by Canadair, Ltd., Montreal, Quebec, Canada (A Division of CONVAIR). The trainer is operated by compressed air and controlled by electrical solenoids, which operate the canopy and seat jettisoning systems.



All aircrew personnel on this station are checked out monthly for ejection procedure and timing. We believe it is an extremely beneficial training aid. Inclosed is a photograph.

Sgt. W. Neil and Cpl. D. Christensen
#7 Field Technical Training Unit
RCAF Station Gimli, Manitoba, Can.

■ ■ ■

Yipe

I write concerning an error which was made in the article you printed in the April issue. On page 22, in the fourth paragraph from the end of the article, "Speed Signs," I had originally written:

"Besides the gradual seasonal shift southward in Summer and northward in Winter of the main position of the jet. . . ."

And this is incorrect. I am afraid that my mind played tricks on me and caused a transposition of two words, namely, southward and northward. To read properly, the paragraph should be as follows:

"Besides the gradual seasonal shift northward in summer and southward in winter of the main position of the jet."

A printed correction in a subsequent issue will be the only thing that will save me. Already I have been blasted with comments. I guess by now you also must have heard about it. It is so natural to think in terms of southward when summer is mentioned and likewise, northward when winter is mentioned. Sorry to have slipped this one in on you.

Capt. Robert A. McCauley
509th F-B Sq, Langley AFB

Thanks for the correction, but no need to apologize to us. We should have caught this obvious oversight before going to press. Let's both apologize to our readers and try to forget the whole thing.

No Horsepower—And that is the theme of this month's Flying Safety Magazine. Power plant mis-management takes its toll each year. Know your engine as well as your aircraft. The understatement of the year is: It's an important part of the team.

Pitch on Props ...page 8

U. S. GOVERNMENT PRINTING OFFICE [illegible]

629.1305
FLYS

FLYING SAFETY

UNITED STATES AIR FORCE

AUGUST
1957

THE LIBRARY OF THE
UNIVERSITY OF ILLINOIS

Your Personal Equipment

File Thirteen

August is Personal Equipment month in our 1957 Flying Safety Program. Personal equipment is something we all take for granted, yet complain bitterly if it doesn't work when we need it. But can you honestly say that you preflight it to the same degree that you preflight your airplane? . . . Some (die-hard) crewmembers are reported still to be wearing nylon scarfs. In the event of fire, the nylon will fuse to the skin and cause painful, if not fatal burns. That's why the K-2B nylon flying suits were withdrawn from issue a few years ago. . . . Word from Hq USAF is that AFR 60-4 will soon be changed to require six instrument (or hooded) radar approaches and six instrument approaches other than radar, within the 12-months period prior to the instrument flight check. Three of each type approach must be made within each six-months period. It might be a good idea to start logging all instrument approaches in the Form 781 for record purposes. . . . Back to the theme for the month, a pilot who recently survived a 54 day stint in the high Sierras (after ejecting from a T-Bird) reports that he owes a lot to an item of equipment not furnished by the Personal Equipment shop—a knife. So say others who have had it happen to them. How sharp is yours? Or, more to the point, do you wear it?

'til September,

Vernon R Stutts

Order a Personal Copy Today

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Please send Flying Safety Magazine for one year to the following address. Enclosed is a check or Money Order for $2.50. ($3.50 for foreign mailing.) Catalog No. D-301.44.

Name______________________________

Address____________________________

City_________________State____________

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Brigadier General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Vernon R. Stutts

Managing Editor
Major James W. Bradford

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby

Editorial Asst.
Amelia Askew

Distribution
T/Sgt. William H. Johnson

CONTENTS

What About Today? 2
May I Ride With You? 10
Well Done 13
Personal Equipment Checklist 14
Would You Accept This Equipment? 16
Those Shocking Altitudes 18
Survival by Accident 20
Your Airplane Isn't Everything 23
Are You Ready? 24
Crossfeed 26
Rex Says 28

VOLUME THIRTEEN NUMBER EIGHT

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

Use of funds for printing this publication has been approved by the Secretary of the Air Force and the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use of material. Such action will insure complete accuracy of material, amended in light of most recent developments. The contents of this magazine are informational and should not be construed as regulations, technical orders or directives unless so stated.

USAF PERIODICAL 62-1

The Wrap Around You

Brig. Gen.
A. H. Schwichtenberg
Command Surgeon
ADC

Let me talk about the items of equipment that have been developed in the various aeromedical laboratories in the United States and elsewhere. As you know, these things are for the purpose of augmenting human capabilities to the point that we can continue to be master of these magnificent flying machines that have been created. For many years, the various design engineers have gone about their business designing engines and accessories and aircraft that can fly much faster, higher and farther than ever before. Of course, there is an urgent reason for this just now.

We are reminded of this often. The general attitude seems to be that somehow the aircrew can be made to adjust to the aircraft environment. We always have, more or less. A few of us remember the crude pipestem oxygen system and the heavy sheepskin garments and boots, together with the helmet and goggles that we all used to think was what the well-dressed flyer would wear. When we got all of this gear on, including our parachute, we could hardly move. In the open cockpit jobs of those days, one nearly froze, particularly in the rear cockpit where I always rode. There was a lot of complaining about the bulk and discomfort of the heavy equipment. Then we went faster and the noise and windblast got so bad that finally canopies just had to be developed. Most of the oldtimers, of course, grumbled about the soft, new generation and sighed for the good old days.

This did get rid of the bulky, heavy clothes and particularly with the development of good cockpit heating and better oxygen systems; the pilot was much more comfortable and able to move freely to do his job with a minimum of impairment because of the personal equipment he was wearing. It was not perfect, of course, but not too bad either for the job at hand and the capabilities of the aircraft then available during World War II.

These new, good old days didn't last long. The B-17s and '29s soon gave way to the B-36s, '47s, '52s, and soon the B-58s. Then the P-40s. P-47s and '61s gave way to the F-80, then the F-86, '89 and '94s. Now come the Century series—the F-100, '101, '102 and '104, and before long there'll be others.

We are back around the full cycle and are hanging so much on our people that it is again most difficult to do the job they are in the airplane to accomplish.

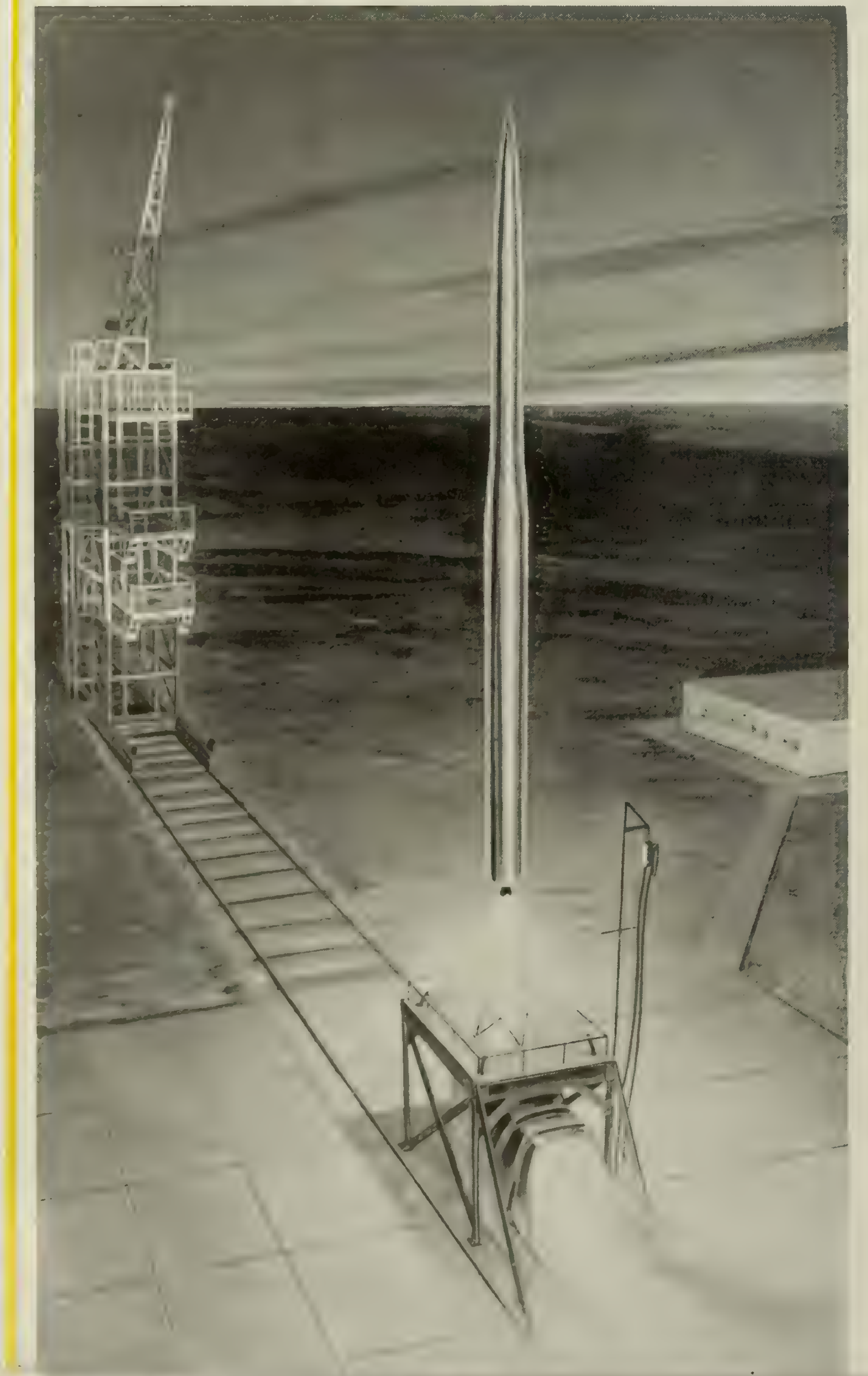
Last spring at the ARDC meeting, the policy change was announced wherein the equipment and reliability would be engineered and built into the aircraft. Thus, the aircrews could again be unloaded to carry on their work more effectively. This is a welcome change and emphasizes that the people (who are the all-important element in this business) were not being given the consideration they deserved. Thus, the pendulum is swinging back toward a middle ground again. Engineers are in the midst of developing ways and means to build safety features into the cockpit of the aircraft. Again, personnel will be able to fly relatively safely without having to wear most of the protective equipment themselves. This will take time.

Meanwhile we have serious problems of everyday nature with which we must cope. The most troublesome are helmet-oxygen mask combination and —with the arrival of the Century series aircraft—the partial pressure suit and helmet. Until we reach the time when a pilot can fly in an aircraft which has all the safety features built in, all of us must devote a great deal more time and attention to the personal equipment we must use.

We should all dedicate ourselves toward devoting still more attention to the people we work with and their problems. We must look toward the prevention or amelioration of conditions which predisposes them to mistakes. Secondly, we must rededicate ourselves to the proposition that flying personnel are no safer than the state of their personal equipment.

During your flying career, you've had to work with various types of equipment. Some did the job and others made you wish for improvements. The improvements will come in the future, but . . .

. . . What About



Col. A. M. "Chic" Henders

Coleman Engineering Comp

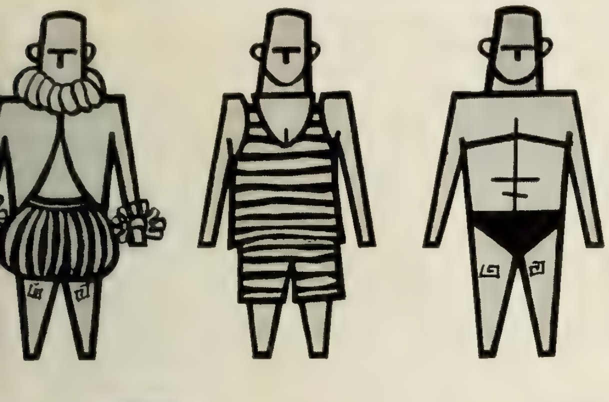
WHILE tremendous efforts are being expended, rightfully so, to provide better personal equipment, stabilized ejection seats and capsules for the future safety of our air crewmembers, what can they look for to protect them right now?

It can truthfully be stated that the outlook isn't too bad, considering all of the facts. Engineers have made and continue to make astounding advances in the design and speed of aircraft; however, little has been done on the design of man since Adam peeked behind the forbidden fig leaf.

Today, you have ejection seats, automatic lap belts, automatic parachute opening devices, canopy releases, partial pressure suits and helmets, ventilating garments, anti-exposure suits, survival kits and other paraphernalia too numerous even to mention.

With various combinations of this personal equipment you can be protected from most of the hazards which may be encountered, should an emergency occur. Of course, it is bulky, heavy and uncomfortable but when it is needed, it'd better be there.

The blind learn to live without sight, the legless without legs. Both have added equipment to adjust themselves to the environment in which they must live—one, perhaps a cane and dog, the other crutches. It would be the ultimate in design if a bathing suit was available that would keep one warm in the cold, ventilated in the heat, dry in the wet, with built-in



Little has been done on the design of man since Adam peeked behind the forbidden fig leaf. Personal equipment supplements his shortcomings.

Today?

AF (Ret.)

Angeles

parachute and pressure capabilities that weighed less than one pound. It is true that such a garment may be found, but to date the only feature available and guaranteed is the weight. Therefore, you must learn to live with the equipment of today. Thorough indoctrination and use make it more readily acceptable.

Physiologically equipped and psychologically prepared you can meet most of the problems of escape today with confidence. Perhaps the two weakest links in our chain are the frailty of the human body and the failure of the human mind to make a decision that it is time to go. Another extremely important factor is that of knowing thoroughly each piece of personal equipment and having confidence in its function.

Certainly there are many questions unanswered. For example, it is known that the human body can take a terrific beating and still function, but what is the dividing line between enough and too much? How strong are the neck, arms and legs, when the wearer of this equipment is ejected at supersonic speeds into a brick wall? Scientists and test subjects today are striving for the answers to these problems and will certainly come forth with a solution. In the meantime you will still fly, so perhaps a little know-how of what to expect may be of value. It is well known that a thorough knowledge of an enemy can assist greatly in his defeat.

First, it is important that you know thoroughly what you have in the way of personal equipment to protect you and, because of the complexities existing in this field today, some of the important items deserve discussion.

Let's talk about a few of these most important items of equipment and how they function.

Parachute Fitting

You are familiar with your parachute but the most important part of it is the one that many people ignore —the fit. A loosely-fitted parachute may cause painful injury, specially in the region of the groins. A properly fitted parachute harness should be uncomfortably tight when the wearer is in any position but seated. Always remember, a parachute, to be of any value, must stay with the individual after bailout. Characters with poorly fitted harnesses have been known to skin right out of the equipment on opening shock. This is extremely embarrassing, for a minute or so.

Canopy Quick Release

A canopy quick release mechanism is installed on your chute, on the main lift webbing, and should be located just below the collar bone in the hollow of the shoulder. On the B-4 and similar type chutes, there is one release on each side. On the B-5, however, only one quick release is installed—on the left hand side. Just as the name implies, when activated, this mechanism releases one side of the canopy in order to effect a rapid deflation of the chute after landing. Thus, it is designed to prevent personnel from being dragged through the water or across land.

The main point is for you to know *how* your parachute is equipped and *how* to work it for what you want to

do. Remember, we said that the older types of harness (such as on the B-4 chute) have two canopy releases. Each release operates one side of the canopy. Depending on what you land on (water, snow or rocky terrain) you will need to vary your technique. If you're in water, you may want to get away from the canopy entirely, to keep from becoming entangled. It may not be necessary, however.

If you land in snow or any other place where you'll be faced with a survival problem, you will need that chute. To pull one release will spill the chute and stop your travel. At the same time you keep the chute. If you pull both releases, you stop traveling but you also part company with it.

On the B-5 parachute, as we said before, you have only one release to worry about. This means that you can spill the chute all right but you can't get rid of it completely until you remove the harness. If you landed in the water and wanted to get rid of the chute, the best procedure is to wait until you are in your raft—then remove harness and all.

Above all, know how the canopy quick release works. Try working it on the ground until you become familiar with it. You will gain confidence in your ability to use it and you won't damage the mechanism or the harness. It can be put right back together again.

Automatic Opening Device

To avoid confusion, here's a bit about parachute automatic opening devices. Since they must work at all altitudes, the devices have two settings: one barometric and one by mechanical release. Perhaps an example would be best:

Suppose you're flying at 30,000 feet. The barometric release is set for 14,000 and the mechanical release for two seconds. You have to bail out at 30,000. Seat separation occurs in two seconds but the parachute does not function automatically until you free-fall to 14,000 feet. Slightly above the 14,000-foot level, the barometric release functions, activating the mechanical release. Two seconds later, the chute opens.

During ejection at less than 14,000 feet, the two-second mechanical release activates as seat separation takes place.

Barometric and mechanical release settings may be varied, so check and know the setting on the chute that you will use on this mission. You'll find these settings listed on the packing card in the pocket of the chute. These devices work in the same manner for non-ejection bailouts except that you must pull the automatic (red and white ball) ripcord. The manual ripcord or D-ring, if pulled, will override the automatic system and the chute will open immediately.

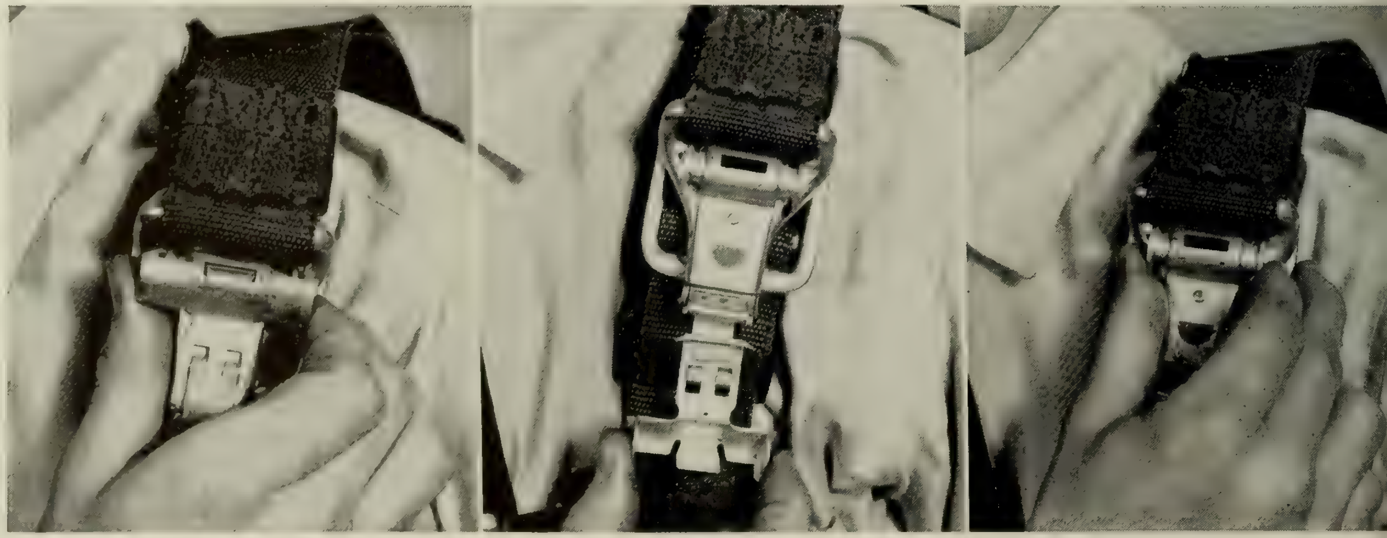
Automatic Lap Belts

Ejection seats may be equipped with automatic lap belts. While the belts may vary, the basic principle remains the same, that is to open the belts automatically. The activating device is gas operated. To make the automatic system complete, the belt and chute are normally used together; however, either may be used without the other.

A completely automatic system would function as follows:

The parachute automatic arming device (red and white knob) located on the left side of the back-type parachute main lift webbing, has a short lanyard securely fastened to it. On the unattached end, a key or keys are appended (two keys and a metal loop). The individual sits in the seat and places the shoulder harness loops on the belt link. The belt links are then placed in position, a key inserted (or the metal loop placed on the link) and the belt closed. Now the belt, while firmly fastened, can be opened manually or automatically.

You should be familiar with the parachute canopy quick release mechanism. By releasing one side only, you can collapse the canopy and still retain it for ground survival purposes.



Located on the seat is a pressure-operated device to open the belt. This release may be set for ¾ to two seconds. As the seat is ejected, the release is activated. Depending on the setting, it fires and automatically opens the belt. By force of drag differential, the individual begins to separate from the seat. As separation continues the shoulder harness loops slide off the belt link and the lanyard attached to the belt key and the parachute automatic arming knob pays out. The key remains firmly locked in the seat belt which remains with the seat on separation and cannot be released unless the belt is opened manually. When the lanyard travels its full length it pulls the knob which activates the chute for both barometric and mechanical release. CAUTION: The lanyard *must not* be entwined around the parachute harness or anything else. If it is, it means you are tied to the seat and separation cannot take place.

What are some of the hazards that you may encounter, should you have to make an emergency ejection or bailout? There are several that can be enumerated, such as hypoxia (lack of oxygen), spinning and tumbling, panic, opening shock, cold, landing and, last but but not least, survival. To escape and not survive is not to escape.

Let's take a hypothetical case where you have made an emergency ejection and follow through the sequence of events that might take place.

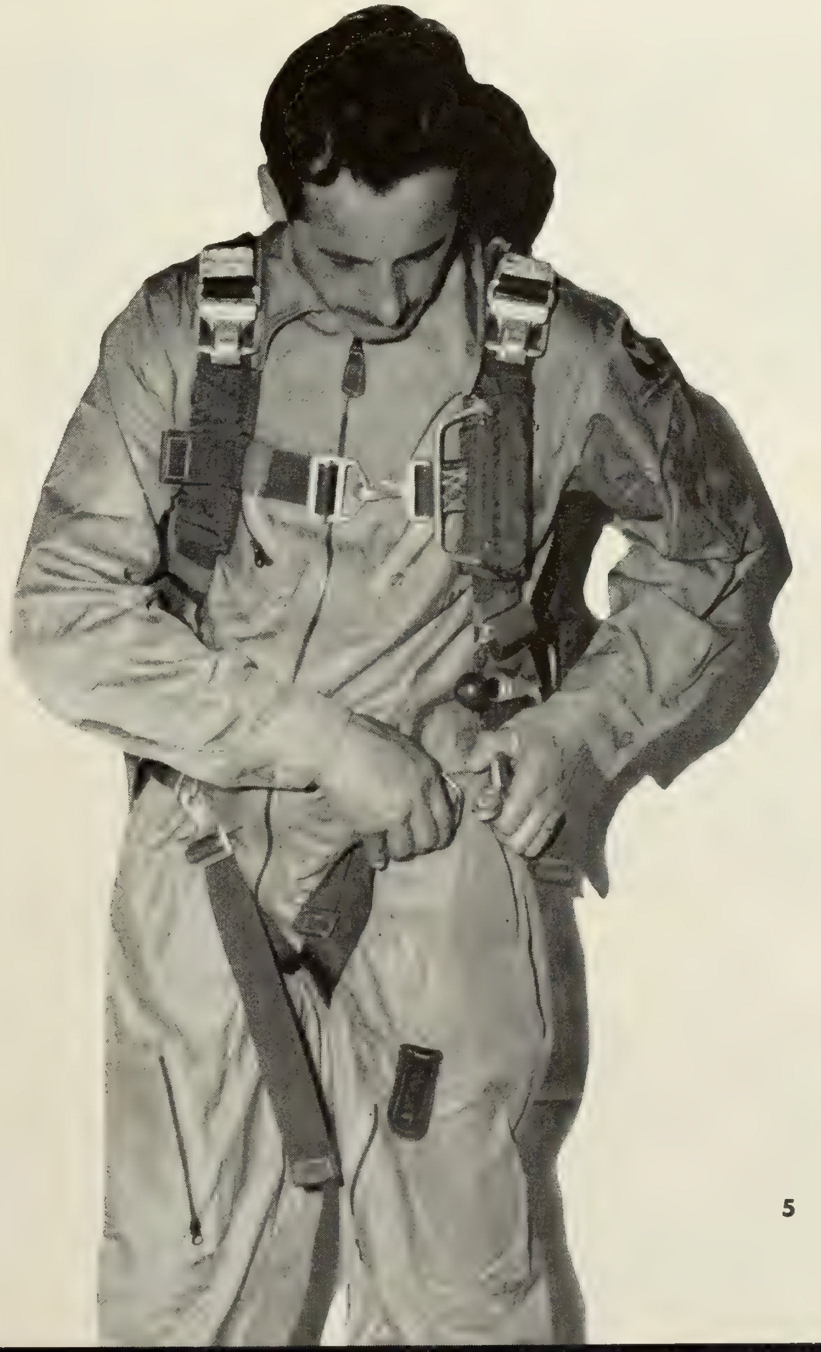
The Seat

The operation of ejection seats vary. At present there are two methods of firing seats:

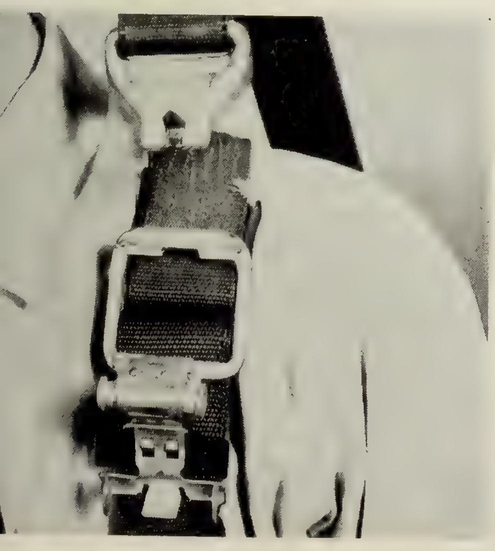
- Armrest trigger (upward).
- D-ring (downward).

Because of the variance in types of ejection seats, different pre-ejection movements may be necessary. It is extremely important that each person in the aircraft receive a briefing on seat operation, during which certain Standard Operation Procedures (SOP) are enumerated. First, it is hoped that you are sitting on a "hot" seat and that the pins have been pulled prior to takeoff, and then—

- Helmet and mask should be secured before canopy is released.
- Lower head and body as far as possible before releasing canopy to prevent injury from canopy (except in downward ejection).
- Sit erect, buttocks well back in seat, head back against the headrest, chin in, shoulder harness locked, feet in footrests (if provided), and activate bailout bottle (if required).
- Grasp firing device.
- Fire seat.
- Following ejection, release lap belt and kick away from the seat as soon as possible. There may be an automatic device to release the belt.
- Delay parachute opening, depending on altitude, to reduce opening shock and allow seat to fall clear. If chute is equipped



A loosely-fitted parachute may cause painful injury. A propertly-fitted parachute will be uncomfortably tight when you are not seated.



with automatic opening device and the seat with an automatic lap belt, you need do nothing but fire the seat.

Ejection

"S-W-I-S-H!" is the easiest way of describing this sensation. If the lap belt and shoulder harnesses are adjusted properly there is no jolt. Nor is there the sickening feeling you sometimes experience in rapidly ascending or descending elevators.

You are sitting relaxed (it is hoped), and then — instantly — you are gone. A kaleidoscopic scene of color unfolds before your eyes. There is no black-out or red-out, but there are a few moments of confusion. By the time you can move your head to look at the lap belt, the seat should be gone and you should be free falling. If for any reason you are held in the seat, check the belt. If it is open, use your hands and feet and push away. If the belt is not open, operate it manually. But remember now, if you do open the belt manually, your automatic parachute must be operated manually by actually pulling the red and white knob.

Windblast

When the ejection seat leaves the aircraft, you and the seat are subjected to windblast and wind drag deceleration which are functions of the air density and the speed, whose combined action is measured as ram pressure.

Windblast is fairly mild up to speeds of 400 knots; that is, you can readily feel the force but it is not frightening or injurious. At higher speeds the force becomes greater and it becomes difficult to restrain the limbs and head. It is therefore quite evident that the speed should be reduced, if possible, prior to ejection.

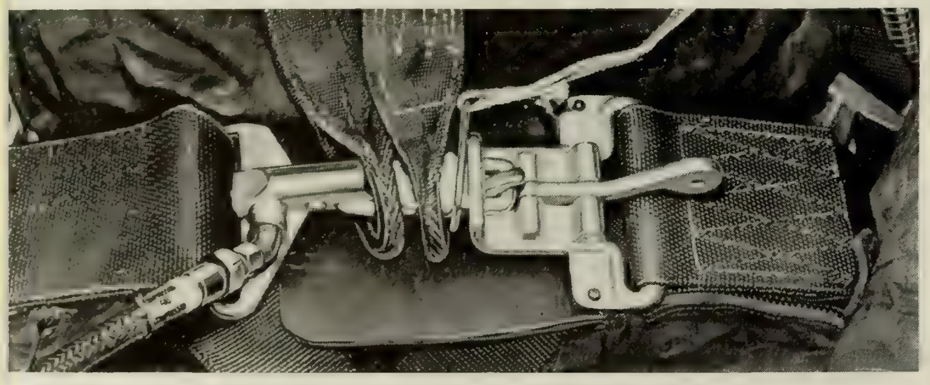
Free Falling

This is best described as a body falling through the atmosphere without the use of mechanical restraint. Actually, there is not any feeling of falling, and there are several advantages to a free fall after high altitude escape, regardless of the means of exit. There is less danger of getting the chute caught on the aircraft. There is less shock when the chute opens. Oxygen is required for a shorter length of time on the way down.

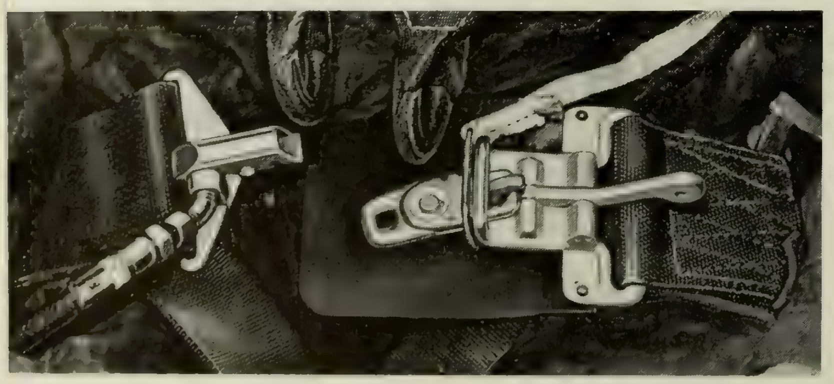
Spinning and Tumbling

A free falling body may encounter tumbling and spinning of varying degrees. Tumbling is defined as the head-over-heels rotation in a vertical plane while spinning is rotation around the vertical axis of the body,

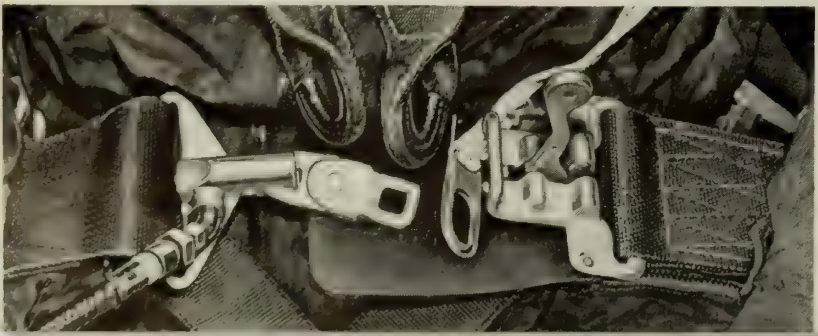
Place the shoulder harness loops and the metal lanyard loop on the belt links, then close the belt. Some belts have a key instead of a loop.



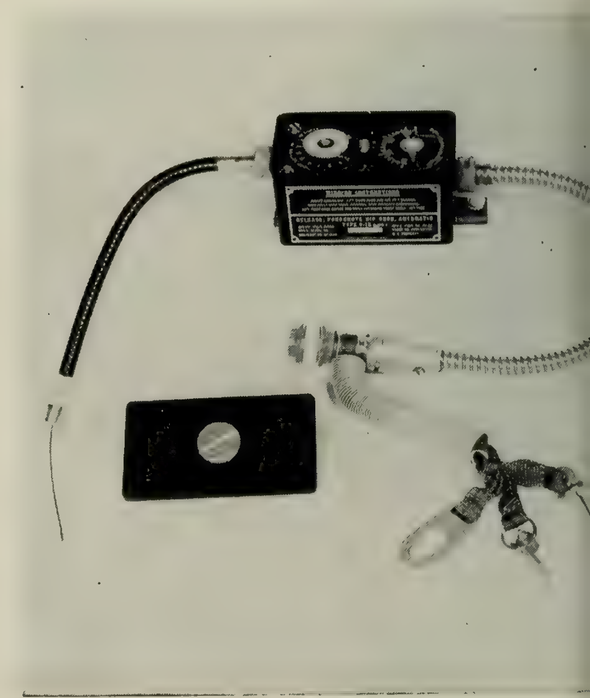
When the seat belt fires, the parachute lanyard anchor is retained by the swivel link. Give the belt time to open before attempting manual release.



Manually releasing belt nullifies the automatic opening. Arming cable must be pulled or parachute can be opened by pulling ripcord.



Type F-1B automatic parachute ripcord release will be set at one second and 14,000 feet.



Tests have been made to study the trajectory of seats. When chute is equipped with an automatic opening device and an automatic lap belt, you do nothing but fire the seat.

commonly known as "flat spins." The eccentricity of spinning and tumbling is such that no known method of control has been developed. By merely exposing a small portion of a hand or arm to the windstream, a person can change the direction of spin. In some instances, waving the arms and kicking the feet (similar to swimming motions) have also been of assistance.

The spinning and tumbling may be fairly violent, weird (if a P-3-4 helmet is worn you'll experience a swishing noise in your ears as your body rotates), nauseating and frightening. But it can't last long.

Body position immediately following separation from an aircraft or seat is important. The best position is chin on chest, body slightly bent at hips, eyes focused on belt area, feet together, the left hand grasping the chute webbing just below the ripcord handle, and the right hand grasping the webbing just above the ripcord handle. In low altitude escape, the right hand should grasp the ripcord handle.

Time to ground from 50,000 feet for a free falling man is approximately three and one-half minutes. To 15,000 or the neighborhood of parachute opening, is just over two minutes. Wait it out; do not panic and pull the ripcord. Remember, the cold, the limited oxygen supply and the terrific opening shock are all against you.

Another possible source of annoyance may be the partial pressure suit, when worn. Be sure that the helmet tie-down cord is pulled down or the helmet pressure will raise the helmet on the head. Moisture caused from condensation may splash around inside of the face piece and it may become partially frosted over during the free fall.

It is also highly recommended that a cloth athletic supporter be worn. This need may not be obvious when the suit is unpressurized; however, in the pressurized state, the testes are subject to position change which could cause extreme discomfort and damage, during parachute opening shock, descent and survival.

Parachute Opening

Parachute opening shock is much greater at higher altitudes than at lower altitudes. At 7000 feet, the opening acceleration is 8 to 9G, whereas at 40,000 it averages 33G.

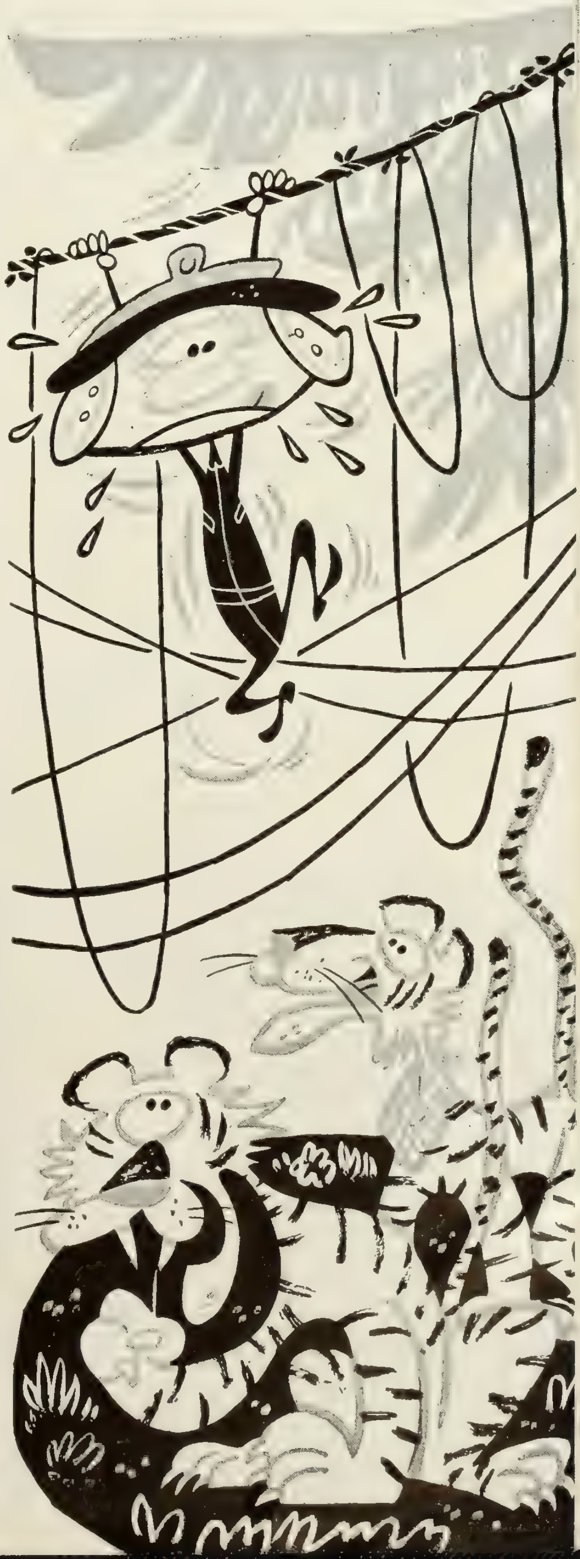
In practice, serious injuries have resulted from the impact of parachute opening at altitudes above 25,000 feet. One method of calculating time while free falling is to count "one thousand one — one thousand two — one thousand three, and so on." Each count represents one second. Caution must be exercised, however, because individuals under these conditions have a tendency to count too rapidly. A little practice helps to get the proper cadence.

Body position for the parachute opening is a most important factor. The same position as for free falling should be assumed prior to parachute opening. With the body in the proper position, it is unlikely that damage will occur, in case the suspension lines foul up during the opening.

When ready to open the back type non-automatic parachute, grasp the ripcord handle with the right hand and pull it down and to the right, across the body.

To open the seat type, non-automatic parachute, pull the ripcord up and to the right, across the body. In either instance, as soon as pulled, tuck your arm in against your body immediately.

When wearing automatic parachutes, no other movement is required after the red and white activating knob has been pulled. Once the ripcord has been pulled, keep your head down, your arms in and feet together.



To escape and not survive is not to escape.

The chute will deploy away from you.

After initial opening shock has been absorbed and you are dangling under the open parachute, be sure to check it visually. Here are some of the most common incidents that occur following parachute opening:

The risers may have several twists immediately over the head. If left alone, they will untwist without assistance.

The "Mae West" (no relation to the life preserver) is formed when one or more suspension lines are whipped across the top of the canopy. This causes two large bulges (hence, the name) to appear with a line or lines drawing in the canopy at the center. By grasping the risers and shaking them, you can usually cause the lines to slip off and the canopy will then resume its natural shape. However, if they do not slide off, forget 'em. At best, it merely increases the rate of descent some, and, well, you're going down anyway!

Open Parachute Descent

Now that the chute is open and you are nonchalantly dangling in mid-air, just relax and enjoy it.

The face piece of the pressure helmet should be removed. If an oxygen mask is worn, it should be unsnapped. If the helmet doesn't have a chinstrap, however, the mask should not be unsnapped. It is the only means of helmet retention. It is extremely important that the helmet be retained for head protection during landing.

The rate of descent varies, depending on the individual's weight and the size of the canopy. A 200-pound man wearing a 28-foot canopy will descend approximately 17 feet per second. The rate quoted is for sea level.

A word of caution: As you approach the ground it may appear that the rate of descent has increased greatly. This is not so; it's merely an optical illusion of what now seems to be the ground coming up to meet you.

Oscillation may be described as the pendulum-like movement of the body, swaying under an open parachute. In some instances it may feel rather severe, but, to date, no one has gone completely around. It may be somewhat descreased by pulling or pushing the risers in the opposite direction of the movement. Extreme oscillation only presents problems during actual landings on the ground.

Body position, while descending, is a matter of personal preference, except for a water landing, and depending upon the type of equipment being worn. (Water landings will be discussed later.) Two choices are open to you when you have time to spare. You can hang in the harness or you can pull yourself back in the seat sling and sit as in a swing. Remember though, ground landings require the hanging position and it should be assumed several hundred feet in the air.

Ground Landings

Body position for a ground landing is extremely important. It is:

- Arms overhead.
- Hands grasping the risers.
- Knees slightly bent.
- Feet together.
- Eyes looking out at a 45-degree angle to the ground.

In this position, the exact time of ground impact will not be anticipated. This will eliminate the hazard of pulling up your legs just prior to impact. As ground impact is made, allow the body to collapse in place; then twist either to the right or left in order to absorb the landing on the flat body surfaces. The parachute may be collapsed by any of three methods:

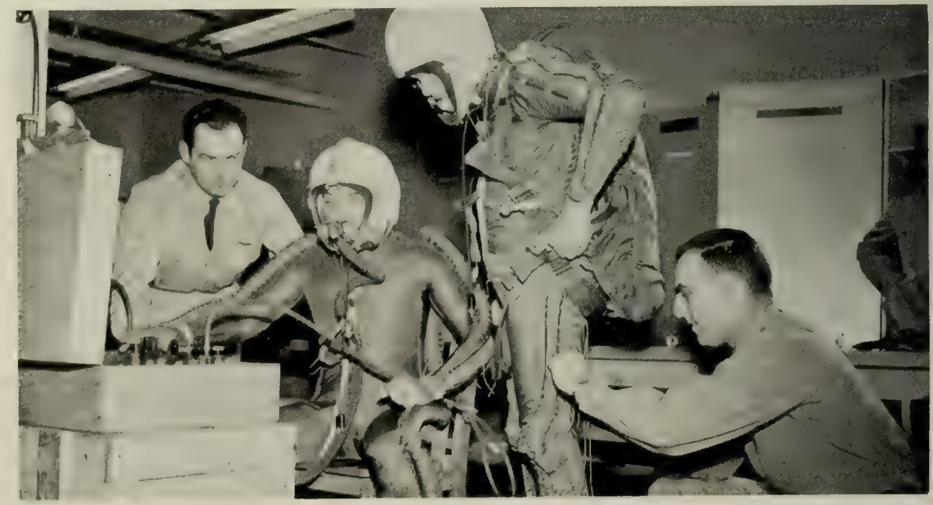
- Canopy release.
- Pulling in on the bottom risers.
- Getting on your feet, running around, if you're able; grasping the apex of the chute and turning it away from the wind.

Landing Impact

Landing impact is something that is difficult to describe. It may be extremely easy, like stepping off a chair. Or, it may be extremely difficult. It depends entirely upon the weather, wind and the amount of oscillation. Never attempt to make a standup landing, no matter how easy it appears. Remember, if the proper body position is maintained, the body can take a terriffc jolt without serious injury. Body rolls should not be attempted. If the landing is hard enough, the body will automatically roll or bounce. Remember what was said about the importance of body position and keep your arms overhead, hands grasping the risers, knees slightly bent, feet together and eyes looking out at a 45-degree angle to the ground.

This same position should be maintained even though it appears that you are going to land right into a

The anti-exposure suit and survival gear are available for issue today. Crews of Century series fighters and jet bombers will be equipped with emergency high altitude pressure suits.



house, fence or on the rocks. Attempting to steer the parachute, slipping and body turns are discouraged. Merely hit the way of the drift, whether it be backward, sideways or forward. The most common causes of injury on parachute landings are:

- Taking your hand or hands away from the risers to try to ward off ground impact.
- Looking down at the ground which tempts you to draw up your legs just prior to impact.
- Failing to keep your feet together. This causes one foot to take the brunt of the entire landing.

Tree Landings

It is entirely possible that you will land in a tree. In most instances, such a landing is quite gentle and not too disagreeable. The main problem, of course, is getting safely to the ground. The body position remains the same, with the exception of the arms and hands. The hands should be grasping the risers across your face. In other words, cross your arms over your face and grasp the risers on the other side. *Don't cross your legs.* Just keep your feet together as you would for any other type of landing.

Water Landings

These are much easier than ground landings. They have been executed into water with fully inflated preservers in 25-knot winds without injury to the man or damage to the preserver.

While the procedures outlined here are relatively new, they are an improvement over the old system and they relieve you of performing actions after water immersion. Here is all there is to it:

- Check the canopy immediately after the parachute opens.
- Remove your face-piece if you're wearing a pressure helmet.
- Unsnap your oxygen mask.
- Push the sling under your buttocks with your thumbs.
- Sit well back in your harness.

(This is the best procedure, but don't worry about it if you have trouble getting back far enough or run out of time. Since you have a canopy release, you can even hang in the harness.)

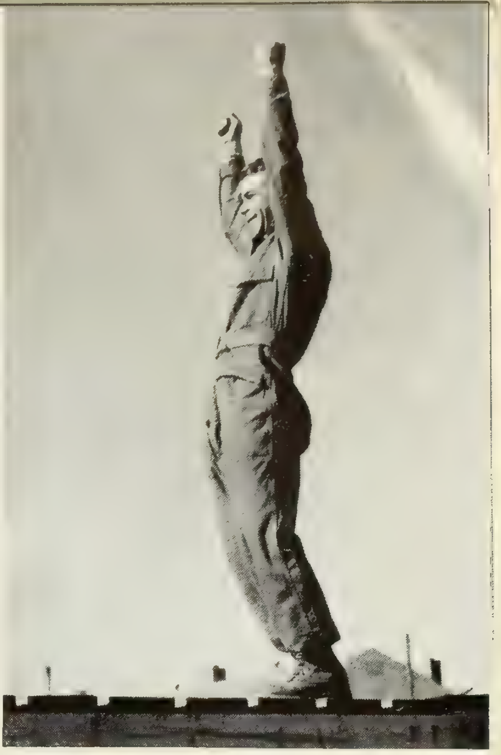
- If you're wearing the B-5 flotation vest (the Mae West, to you), unfasten or loosen the chest strap. You'll be more comfortable when it inflates.
- If you're wearing the MA-2 (Underarm) preserver, you don't have to bother with the chest strap at all.
- Inflate both sides of the preserver. (There is a separate pull cord for each side.)
- Pull down on the canopy release guard. This can be done safely at any altitude.
- When your feet contact the water, squeeze the canopy release buttons and rotate the clip out and down.
- Move away from the canopy to prevent tangling with it.
- Inflate your life raft.
- Climb into your life raft and paddle for home.
- Use the sea marker, shark repellent and signal mirror, as required.

Survival Kit

If you are equipped with an automatic kit, it should be activated during the parachute descent. The raft will drop out inflated, under you, on a thirty-foot lanyard. On the end of this lanyard, the balance of your survival equipment is encased in a waterproof container. Once you're in the water, all you have to do is grasp the lanyard and pull the inflated raft to you.

There are two methods of boarding a life raft. Here's the first one:

- Grasp raft and make sure it is right side up with narrow end toward your body.
- Face raft, place both hands on narrow end and push it down under your body. Move your hands to the boarding straps and pull your body onto the raft.



Keep your arms overhead, hands on the risers, knees slightly bent and feet together.

And now for the second method:

- Grasp raft and make sure it is right side up with narrow end toward your body.
- With back toward raft, place both hands on narrow end and push it down under the buttocks and slide in backwards.

The advantages of these procedures, in performing many functions in the air while descending, are:

- If malfunction of preserver cartridge occurs, oral inflation may be accomplished.
- You can see what you are doing, as opposed to fumbling about after becoming immersed.
- Water immersion is greatly decreased, causing less confusion.
- Decreases "panic" possibility.
- "Peace of mind" for you—everything is done.

In summary, the following points should be considered:

- Preflight inspection of your parachute and flotation gear is a MUST.
- Wear the chute properly at all times. Remember *time* is important in an emergency.
- Know what you are going to do, in case of an emergency, before you take off.
- If you do have to jump, relax and enjoy it. Thousands before you have done it, successfully. ▲

★ ★ ★

About the Author

Col. A. M. "Chic" Henderson, now retired after 32 years of service, was formerly assigned to WADC as Asst. Chief of the Aero-Med Lab. He is rated as a Master Parachutist, with a record of 127 jumps. He has personally test-jumped such experimental USAF personal equipment as ejection seats, automatic lap belts, anti-exposure suits and survival kits. He made the first test downward ejection from a B-47 jet bomber. Col. Henderson also participated in the program to determine the physiological limitations of the human body during periods of "free fall" through "unfriendly" high altitudes. His work in the field of developing personal equipment and escape is indeed outstanding. He's presently assigned to Project SMART. Perhaps you know him as "The Jumping Grandfather."

May I Ride With You?

FLYING SAFETY presents the passenger's point of view. Although originally published three years ago, the story is still apropos.

I'M A GROUND type, ground pounder, paddle foot—non-rated. Why? Because some flying instructor back in 1940 told me after 10:28 hours of PT-17 time that I couldn't hit the ground with my hat, let alone land an airplane. I met the board. All that was said was "It's been nice and thanks, but no thanks for any more." And that was the last word.

"Yes, Sir."

Come fall this year, I will have seventeen years in the Air Force, a comforting rank and a lot of passenger flying time, both in the ZI and overseas. A little has been in jets but mostly in gooneys, B-25s, C-45s, C-54s, T-6s, B-17s, C-121s, C-74s and L-20s. Some years I average 12 to 15 hours per month in the blue on various TDY assignments.

I've ridden with all types of pilots and aircrews. Today, I have a clear-cut picture of the guys I like to ride with; an equally vivid memory of those who made me wish that I'd been shopping with the wife—something I detest.

Suppose you are flying to Timbuctoo tomorrow. I call you the day before the flight to find out if you have room for me.

You say, "Be at Operations at 0615."

I show up at 0600 and find you've already started your clearance. This I like (and I know that you like my being there early). I've come to respect the pilot who has set a takeoff time and expects to meet it. The entire ride will reflect the same precision. You ask me if I care to get the weather with you. I chalk up another bonus point because you're the type who appreciates the interest every passenger has in the entire flight plan.

I realize, by the way, that passengers are not ordinarily allowed in either the Ops or Weather Office. Hence, I don't expect the plush treatment and accept it only on invitation and when I won't be adding to the confusion of things.

The paper work is completed and we walk out to the airplane. You introduce me to the rest of your crew and that is important to me—that personal interest in the people with whom I'm sharing this adventure. The opposite, all too familiar, scene goes something like this:

"Who's going on 3256? Joe, have you got any maps? Who has the clearance? Sergeant, how many chutes are there? Let's leap."

Brother, think I, this is another of those real gone rides. They want to get off the ground before someone cancels their cross-country. That gal simply will not be kept waiting. Bet they want to get us peasants off at the first stop.

This isn't meant to be the latest word on the niceties to be observed when traveling by military air. Rather, it is another impression to help define an attitude or frame of mind that ultimately adds up to the professional airmanship we all respect.

Let's get back to where we were walking out to the airplane. I follow you around as you make a visual inspection. You pay particular attention to the controls, step up on a tire for a close look in the wheel well. I don't know what you're looking for but am confident that you do.

Before starting the engines, you get the attention of all the passengers and explain the flight plan. The crew chief passes out the parachutes. You ask everyone to try his on.

The Sergeant says, "Colonel, your leg strap is a bit loose. May I tighten it for you?" He helps me and I think, "They're leaving nothing to chance. These guys are good."

"How many of you've ever used a parachute?" No reply.

"I've never had to jump either, but here are some points to remember: Keep your head down when and if you jump. Look at the D-ring, but don't put your hand on it until you're out. Turn around and watch the plane—a gimmick to make sure that you are well cleared. You know how to turn over in the water while swimming? It's just the same in the air. Twist your body and you'll turn. Keep your feet together. It keeps the shroud lines from between your legs."

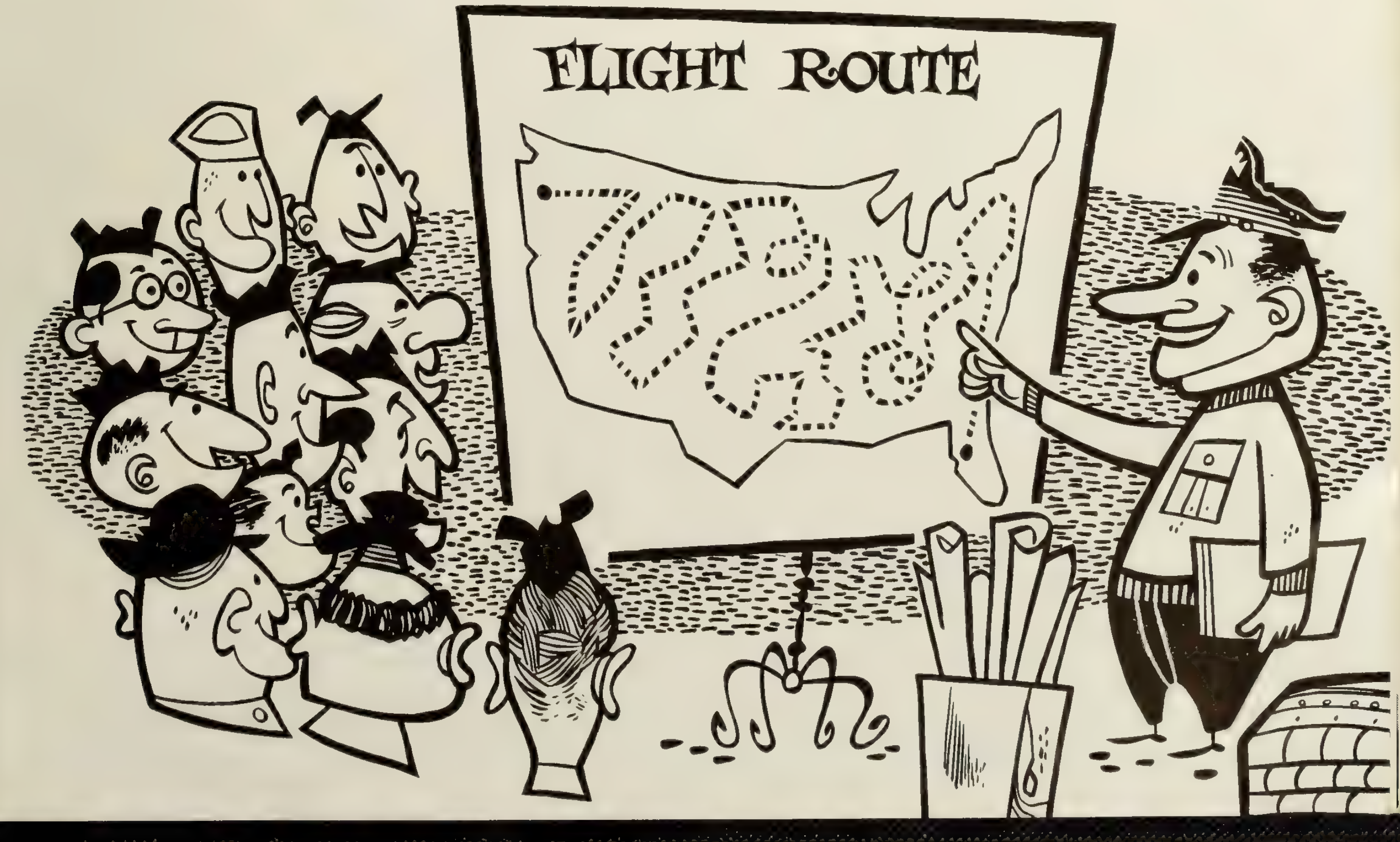
After this, he continues through the routine and then explains alarm signals, emergency exits and procedures.

I've never been comfortable with an aircraft commander who takes all these explanations for granted, any more comfortable than I would be on a ship that failed to pull the customary lifeboat drill. I've been through the procedures many times and I want to hear them many times again. Not so much for my sake after all these years, but for the benefit of the young clerk-typist who is going home on his first leave; the cute little WAF with the engagement ring (somebody should have told her about parachutes and skirts); and the sailor going to Kentucky after two years of sea duty.

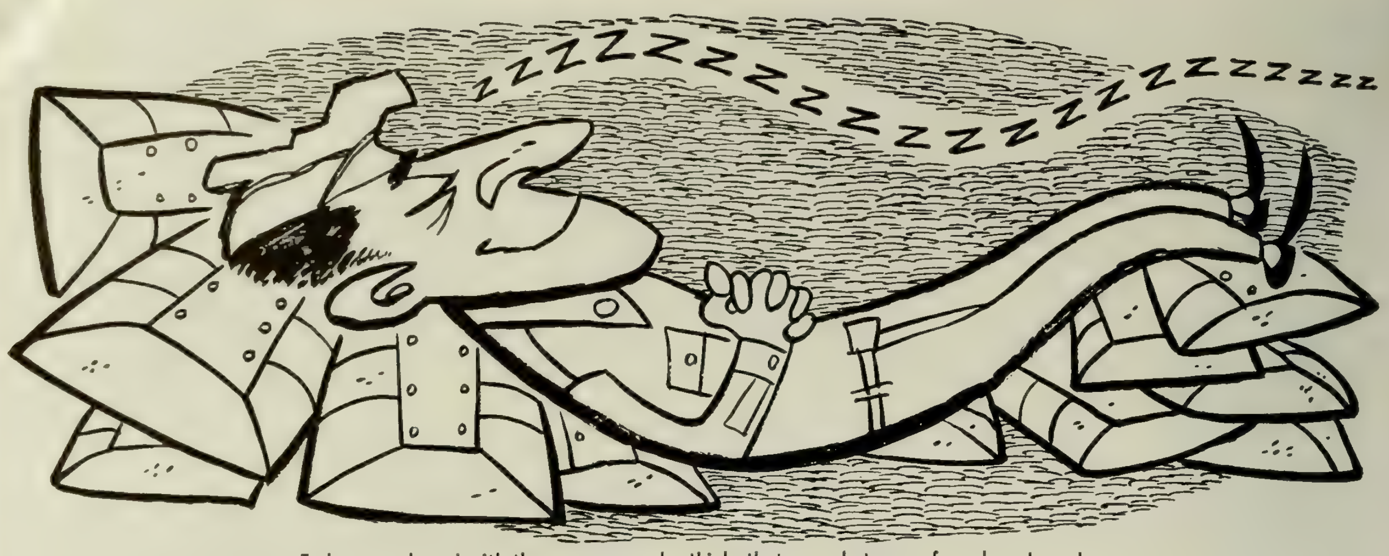
Sure, all of us like to act like seasoned space hoppers. Ever heard a passenger ask for a briefing on emergency procedures? Down in the heart we know something is missing when the commander does not solve the mysteries that each passenger is thinking about.

A little knowledge is a hazard to a ground pounder's peace of mind. He learns a smattering about engines, about flying techniques; he picks up a little weather lingo; realizes that there is an air traffic control agency;

Should have told that cute little WAF that chutes and skirts don't mix.



The pilot explains the flight plan, alarm signals, emergency exits and procedures to be used.


Embarrassed am I with the passenger who thinks that parachutes are for a beauty rest.

that some planes fly farther on a given amount of fuel than others, and that there are needle-ball and airspeed indicators, plus a gaggle of other gadgets and gages to make like a bird. Most of all, he knows that there is a lot he doesn't know and hopes and trusts that the crew does.

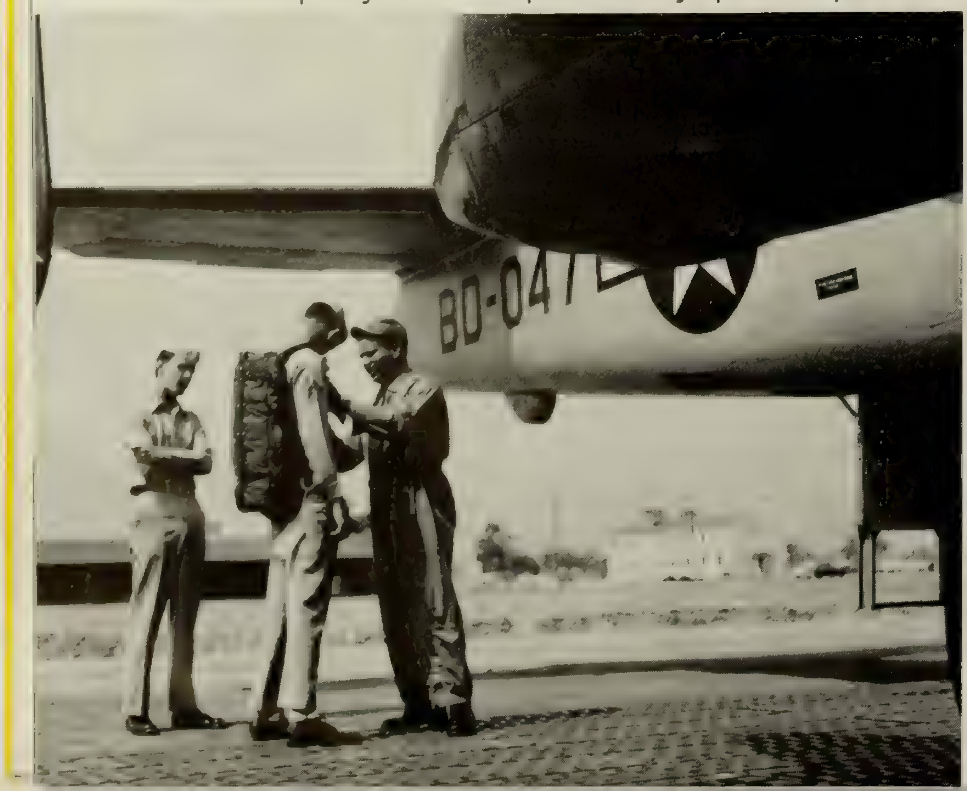
Flying along, do you sometimes put down the magazine you're reading and begin wondering about it all? Especially when everything shudders in a steep climb or turn, when the props get out of synchronization, when power and pitch settings suddenly change, and when the furniture for the new NCO club stampedes down on you in severe turbulence (this has happened).

When these random thoughts pass by, you realize that you are automatically doomed to the uneasiness which a little knowledge breeds.

Little things count, like seeing the pilot walk back occasionally. On a recent flight on a foreign airline, my seatmate, obviously a well-traveled European, said, "What I don't like about this airline is that I never see the Captain. I like the airline whose skipper introduces himself to the passengers, tells us about the flight and then tells us each time he makes a change."

His remarks reminded me that another airline attached to my timetable and ticket a booklet that explained why the atmosphere is sometimes rough and compared its effect on an airplane to a ship in heavy seas.

Well-briefed passengers will be less a problem than a group that was mystified before takeoff.



All of this adds up to confidence in the equipment and the people. You say, "You're getting a free ride—you want a free book, too?"

No, but I figure the effort the commander makes to let his brood know that he is aboard and really in command, shatters uneasiness and reflects well on himself and my branch of the service. Should an emergency arise (this has happened, too), the confident group of passengers will be less a problem than a group that was mystified and perhaps slightly apprehensive at takeoff.

I have also come to appreciate that aircrews make equally valid observations of their passengers.

I wince with the aircraft commander when passengers expect his crew to hop bells for baggage; suffer with the pilot who keeps one hand on the elevator trim because passengers are holding a track meet in the rear. But most embarrassed am I with the rider who thinks safety belts are for sports cars, parachutes for a beauty-rest and Mae Wests a cushion for precious personal baggage. Another pet peeve is the sick passenger who is ashamed to reach for a paper bag—or even his hat — and the matador who gets that gored expression when told to quit monkeying around with the door handle.

This has been written for the benefit of us who frequent the passenger lounges, asking the question, "May I ride with you?" bargaining that the travel time we save is worth taking on any and all comers as a crew and not always appreciating the usually competent airmanship that gets us from here to there. ▲

WELL DONE

Major J. R. Stevens

33rd Air Rescue Sq., Okinawa

MAJOR STEVENS was flying an SA-16 on a local flight just south of Okinawa when he was notified that a Tow Reel Operator had fallen from a B-26 from 10,000 feet, some 98 miles out to sea. After flying to the scene and setting up a search pattern, the downed airman was sighted struggling to remain alive in 16-foot waves. Seas of this height are far beyond normal capabilities of the SA-16; however, Major Stevens realized that the airman could not survive until surface craft arrived. He also knew that unless the landing was executed perfectly, the aircraft and crew, as well as the downed airman, would be sacrificed. Relying on the skill and experience gained from six years of rescue work, he brought the SA-16 into the turbulent seas in a classic, full-stall landing. Inspection revealed that the aircraft was undamaged and the water-logged survivor was quickly picked up.

With his wet passenger safely on board, Major Stevens made two attempts to lift the 28,000-pound amphibian from the water and twice was beaten back. The aircraft was taking a tremendous pounding during each takeoff run and the pilot felt that in all probability, further attempts would break the fuselage wide open. His decision then was to taxi the aircraft 98 miles back to Okinawa. Now, airman-turned-sailor, though barely able to control the plunging amphibian, he fought the seas for 9½ hours back to base. A "record" for sea taxiing distance was thus established!

The quick decisions, expert skill and complete knowledge of his aircraft's capabilities resulted in another life being saved. Major Stevens' actions upheld the high traditions of the Air Rescue Service and the United States Air Force. Well Done!

Personal

In our business the word "preflight" is an all-important one. We think of it, however, as referring to the aircraft only. But it also applies, with equal importance, to personal equipment.

The term PERSONAL is very apropros, for if it doesn't work when we need it, it gets too personal for comfort.

So, let's get with it. Expand on that careful preflight inspection to include your personal equipment.

The following checklists do not include all items of personal equipment but they do cover those pieces of equipment most commonly used.

• P-3, P-4 Helmets •

Fit	Properly adjusted and fitted by the Physiological Training Section.
Shell	Free of cracks and ruptures.
Lacing and Cords	Proper tension.
Knots	Securely tied.
Oxygen mask tabs	Serviceable condition.
Earphones	Not loose or torn.
Visor assembly	Lens not scratched to extent that vision is impaired. Assembly functions properly, opening between mask and helmet does not exceed ½ inch.
Chin strap	Properly attached and adjusted.
Communication cord	Serviceable condition.
Oxygen mask	Properly attached and fitted.

(T. O. 14P3-4-1)

• Parachutes •

Log	Check for accomplishment of 10- and 60-day inspections.
Pack and Harness	Check external condition for visible defects.
Ripcord	In place, handle not sewed or snapped to cover. Pins in place and not bent or corroded.
Automatic Opening Ripcord	Proper time and altitude setting; proper attachment of power cable and power cable housing to dual mounting plate. Plate undamaged.
Aneroid	Check for leaks.
Ripcord seal	Intact.
Arming cable knot guide	Secured to pack assembly.
Pack opening bands	Serviceable condition.
Canopy quick release	In closed position.
For correct fit	Check instructions sewed and stenciled on the cushion of chute.

(T. O. 14D1-2-61)

• Oxygen Mask •

Attachment	Mask secured to helmet suspension studs with screws.
Mask	Cleanliness, sealing of inlet and exhalation valves; free of nicks, grooves, scratches and other damage affecting sealing action.
Hose and Rubber Parts	Cracks, cuts, other signs of deterioration.
Straps	Signs of fraying and wear.
Inlet check valves	Plastic covers installed with arrows pointing downward.
Lip Strap	Serviceable condition.
Hose clamps	Secured at both quick disconnect and mask ends.
Gasket and C-ring	In place on quick disconnect end.
Inspection	Mask should be cleaned and inspected at least every 30 days or more often, depending on use.

(T. O. 15X5-4-2-44)

• Life Raft (Seat type) C-2A •

General Condition	Examine for holes, tears, oil, hydraulic fluid and mildew. Check date of last inspection.
Slide fasteners	Operational.
Cylinder to inlet coupling nut	Tightness.
Accessory kit lanyard	Attached to cylinder nut.
Inner pull tab	Attached to inner inflation valve. A 90-day inspection is required on all rafts under three years old. A 60-day inspection is required on those over three years old.

(T. O. 14S3-2-1)

• B-5 Life Vest •

CO_2 Cylinders	Charged. Cylinders must be weight-checked every 30 days and date of inspection shown.
Compartments	Check for leaks by orally inflating both sides. After check, deflate vest and lock oral inflation tubes.

Equipment Checklist

Accessories	Sea marker (yellow packet); whistle; shark deterrent (blue-green packet); recognition light (do not stow in vest pocket but in holder attached to right side webbing strap. Signal mirror; signal flares. Battery BA-30 should be of latest date.
Fabric	Free of oil and grease that will deteriorate bladders. Date of inspection should be properly stenciled and serviceable tag attached showing date next inspection is due. A six-months inspection is required on B-5 vests not exceeding three years old, and 60-day inspection for B-5 vests over three years old.

(T. O. 14S2-2-1)

• MA-2 Life Preserver (Underarm) •

General Condition	Free of holes, tears, oil or grease; stitching not frayed or torn.
Cotterpins	Not damaged or corroded. Insure sealing thread is intact and properly installed.
Accessories	Sea marker; whistle; recognition light; shark deterrent; signal mirror, signal flares.

(T. O. 14S2-3-1)

• Anti-G Suits •

Bladder	Check for leaks and condition.
Hose assembly	Serviceable condition.
Zippers	Serviceable condition.
Laces	Check for damaged or missing laces.
Buttons	Check for damaged or missing buttons.
Fabric	Check for tears, open seams or frayed areas.

(T. O. 14P3-6-1, G-3; G-3A suit
14P3-6-11, G-4A suit
14P3-6-31, MB-2 suit)

• H-2 Bailout Bottle •

Pressure	1800 psi.
Pull cable	No frayed or broken strands.
Bayonet fitting	Insure that it mates with mask fitting; connect before takeoff.
Ball	Attached to pull cable.
Tubing	Serviceable condition.
Caution Tag	Pull before flight (aircraft equipped with ejection seats); other aircraft, retain tag until use is desired.

(T. O. 15X-1-1)

• Seat Type Subsistence Kit •

Container, cushion and harness	General condition. Check for holes, abrasions, frayed harness.
Seams	Check for gaps or torn areas.
Seal	Intact and properly attached.
Seat pan assembly	Sheared studs or eyelet damage.
Seat cushion	Two-inches thick, and properly attached to container.
PK-2 Life Raft	Inspect and insure raft container is attached to chute.

(T. O. 14S3-2-13)

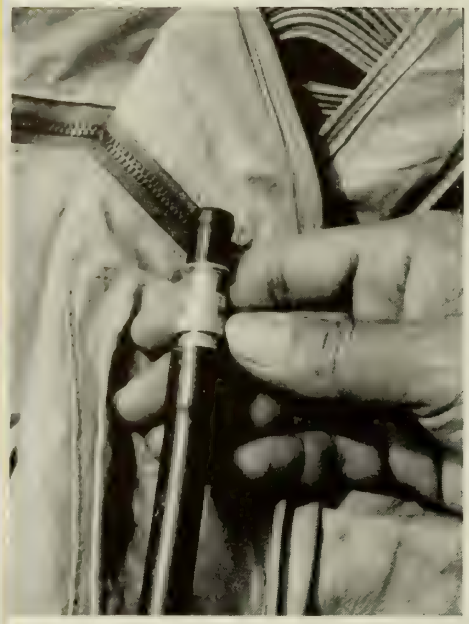
• Exposure Suit R-1, R-1A •

General Condition	Visually check condition of suit container; it should be free of holes, tears and the seal should be in place.
Emergency Entrance Tab	Not unglued or torn.
Serviceable Tag	Attached, showing date of last inspection. A 60-day inspection is required on all R-1 and R-1A exposure suits.

(T. O. 14P3-5-21)

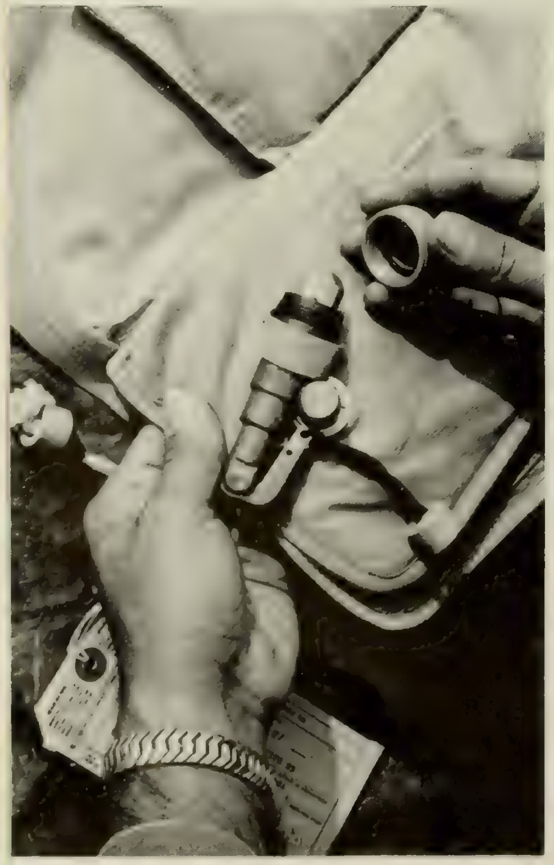
WOULD YOU ACCEPT THIS

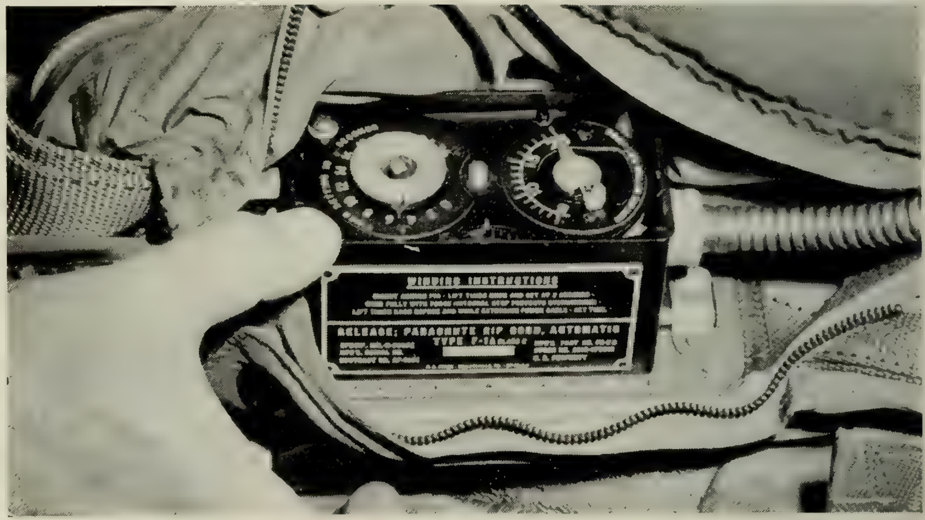
Can you spot what's wrong with the personal equipment shown on these two pages? Would you be willing to fly a mission with what you see here? Pencil in your guess and then turn to page 19 to see how sharp you are.



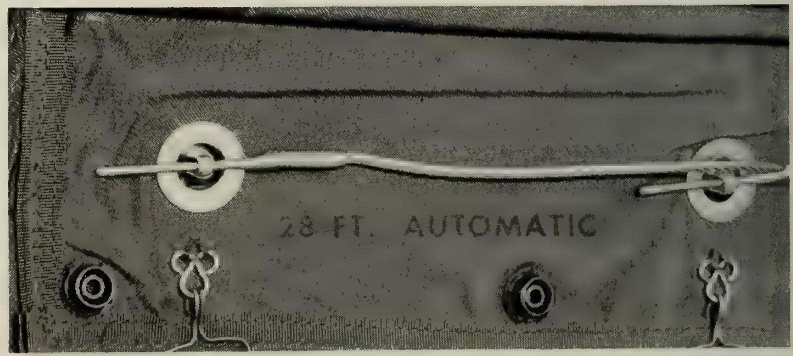
1.______________________

2.______________________



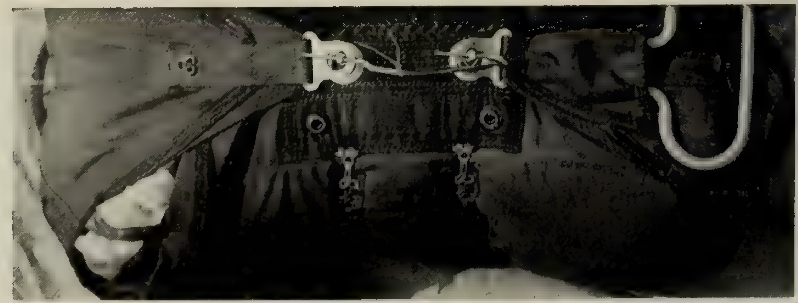


3.______________________________________

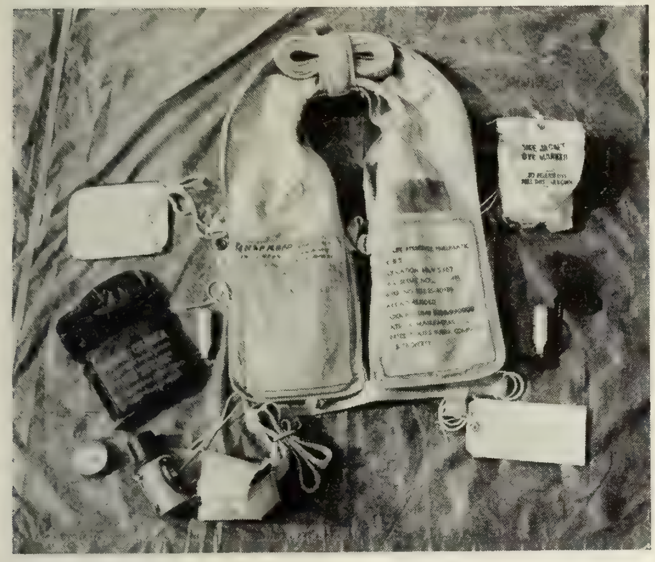


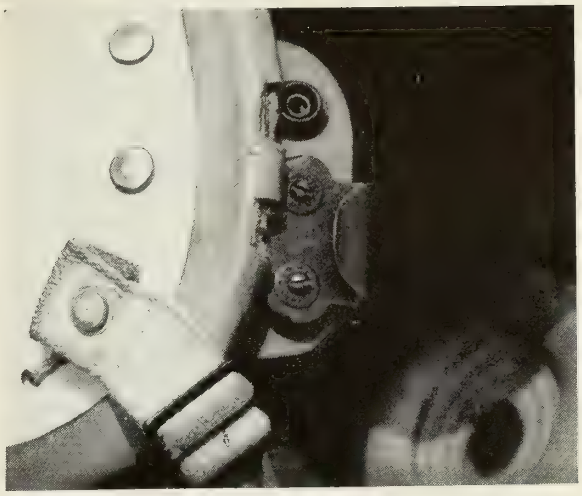
4.______________________________________

5.______________________________________



EQUIPMENT ?



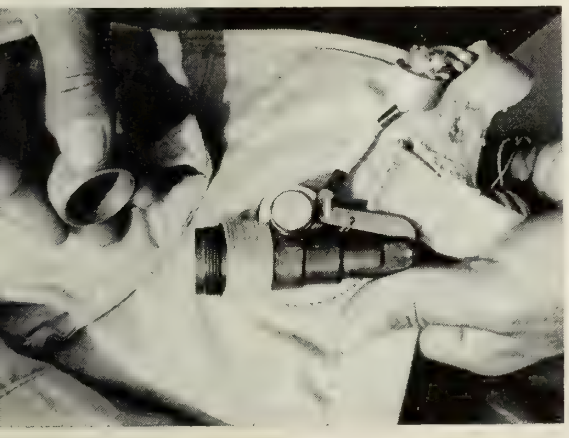


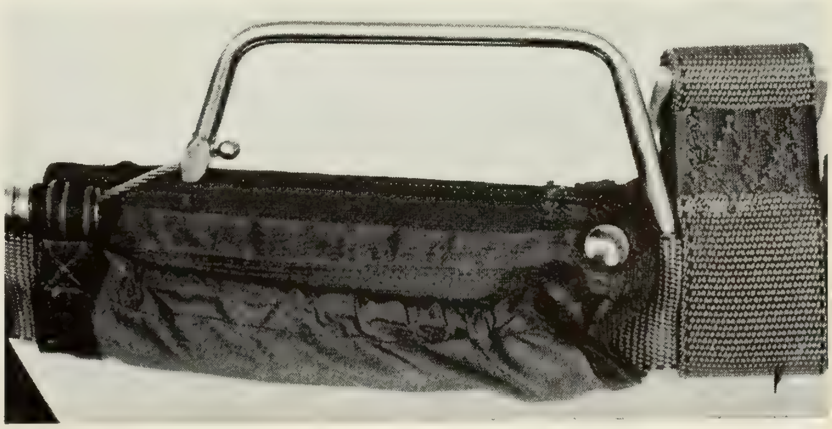
6.______________________________

7.______________________________

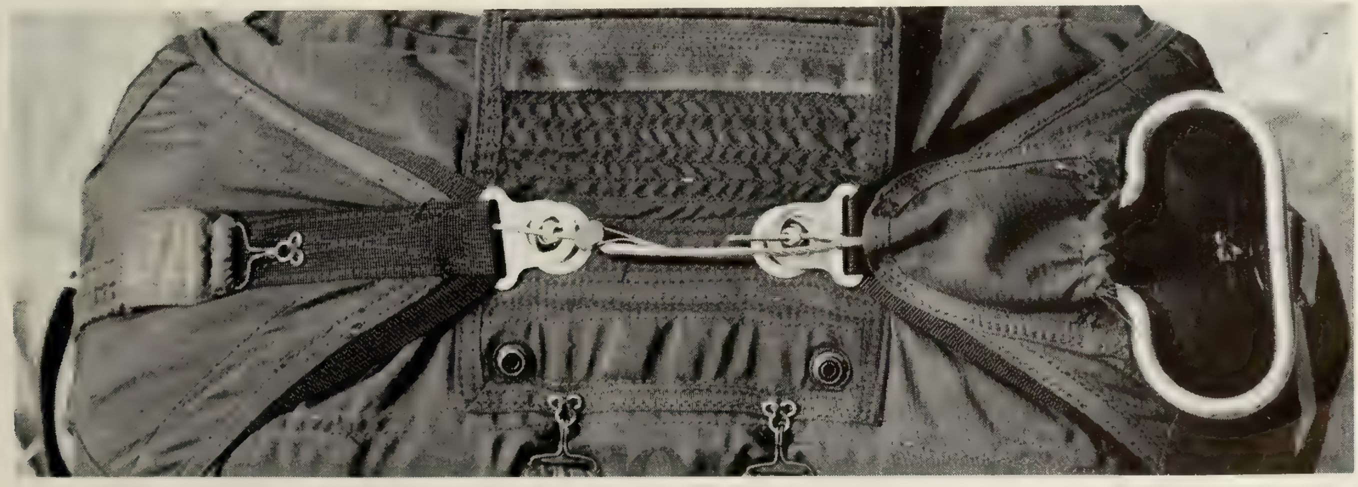
8.______________________________

9.______________________________





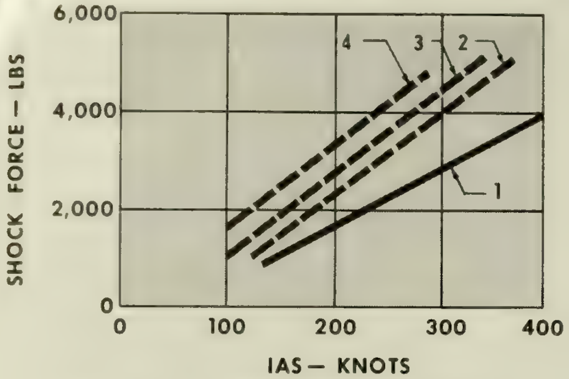
10.______________________________



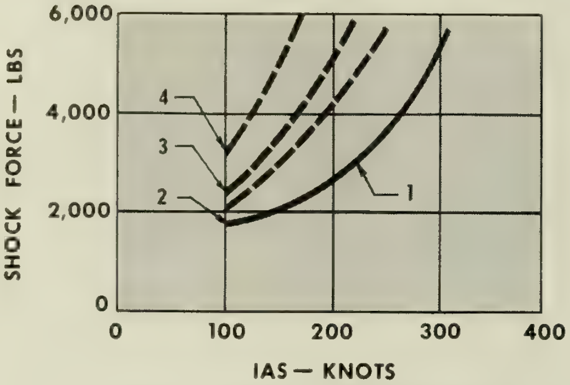
Those Shocking Altitudes

This article was prepared by the Parachute Branch, Equipment Lab., WADC.

PERSONNEL PARACHUTE PERFORMANCE
CANOPY SHOCK FORCE VS INDICATED AIR SPEED



Type C-11 canopy, assem. P/N 50C7024-12 &-13



Type C-9 canopy, assem. P/N 50C7024-9 &-10

LEGEND
1 Drop test data for sea level
2 Drop test data for 7,000 ft press alt
3 Drop test data for 14,000 ft press alt
4 Drop test data for 20,000 ft press alt

FIG ONE

THE Wright Air Development Center has established 14,000 feet as the fixed altitude for automatic parachute aneroid controlled operation. The aneroid setting was selected to obtain lower altitude escape capabilities with a minimum compromise to high altitude-high speed escape.

Flying in the Denver, Colorado, Mt. Whitney and Mt. Shasta, California, or Seattle, Washington, areas, you may note mapped altitudes of 14,000 feet and higher. It registers that something must be wrong; the two just do not seem compatible. But actually, your chances of flying and having to escape over these areas are pretty remote. The reasoning behind setting 14,000 as a fixed altitude is based upon a series of compromises involving terrain altitudes, survival (hypoxia and exposure from high altitude bailouts), and, most important, parachute opening shock.

In the United States, all of the terrain above 14,000 feet is in the form of peaks. The total area of all peaks at the 14,000-foot "plateau" is approximately 20 square miles. The largest single area is Mt. Shasta, with about three and a-half square miles.

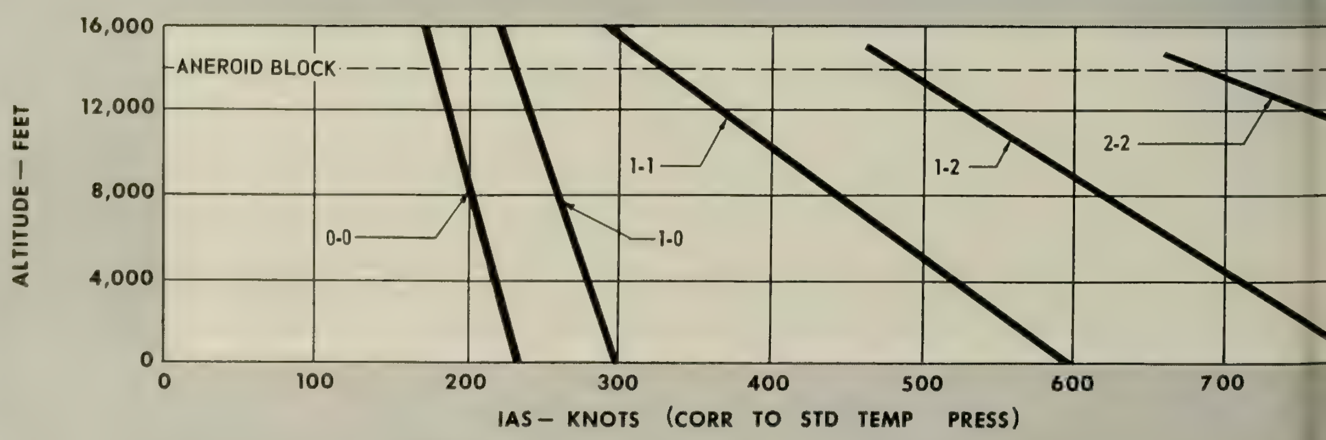
In the Alaskan Territory the total area above 14,000 feet altitude is approximately 140 square miles, with Mt. Logan accounting for some 50 square miles.

With the exception of isolated peaks in Africa, Arabia, Antarctica and New Guinea, there are only two other areas in the world which are predominantly over 14,000 feet. These are the Andes Mountains of South America and the Himalayas of Tibet.

An altitude of 14,000 feet will be sufficient for most training and operational conditions. The automatic parachute releases are so constructed that under special mission or area conditions, altitudes may be reset.

The actual aneroid block is 1500 feet above the dial

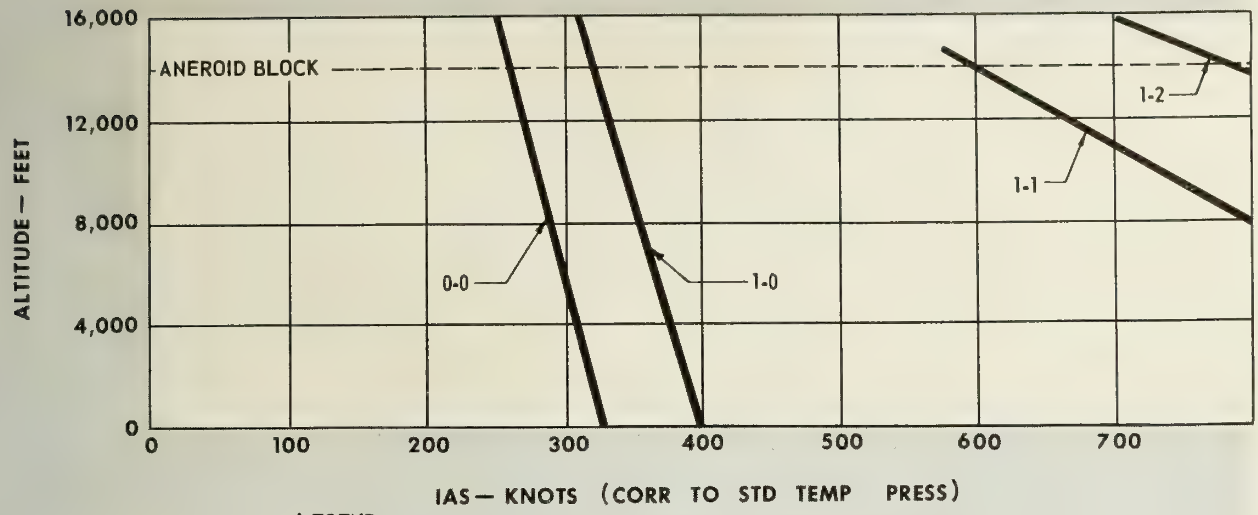
SAFE EJECTION SPEEDS ALTITUDE VS SEQUENCE (LEVEL FLIGHT)



LEGEND
Type C-9 28 ft flat canopy, type B-4 pack, P/N 50C7024-9 &-10
dummy weight -250 pounds; total seat-dummy weight 350 pounds.

FIG TW

SAFE EJECTION SPEEDS ALTITUDE VS SEQUENCE (LEVEL FLIGHT)



LEGEND

Type C-11 30 ft guide canopy, type B-5 pack, P/N 50C7024-12 &-13 dummy weight -250 pounds; total seat-dummy weight 350 pounds.

FIG THREE

setting of the automatic release device. This is done to provide a safety margin to overcome allowable variations in aneroid altitude sensitivity and preset time delays. In other words, a device set at 14,000 feet would always operate above 14,000 feet.

High altitude parachute openings, aside from producing severe opening shock, will produce long descents where hypoxia and exposure to the colder atmosphere become a problem.

Opening shock increases with altitude. Figure 1 shows a comparison of opening shock (average) versus indicated airspeed. When these parachute opening characteristics are applied to the ejection sequences, the safe ejection speeds noted in Figures 2 and 3 are obtained. Figures 2 and 3 are based upon the maximum safe parachute opening speed and/or the opening shock within human tolerance.

To sum it up, let's take a hypothetical case: The automatic ripcord release is set at 20,000 feet and two seconds time. The aircraft is an F-86D on an intercept mission. The parachute is a standard 28-footer. The escape sequence is a two-second initiator on the lapbelt and the two-second parachute release. On climbout at 20,000 feet, you have to eject. This ejection speed and altitude places the pilot in a position where the highest parachute opening shock can be obtained (20—25G). If the pilot ejects at this altitude, exposure to high altitude atmosphere (down to 15,000 feet) will last some three minutes and the over-all descent (neglecting winds and thermal currents) will be approximately 15 minutes to sea level. Assuming the pilot is in shock and just hanging in the harness, the lack of oxygen will cut down his chances for survival. Or if he lands in a tree and cannot get down, his chances of survival likewise decrease rapidly with time. Had the same pilot been equipped with an aneroid setting of 14,000 feet, the parachute opening would have been mild to moderate. Exposure between ejection and 15,000 feet would be in the order of 20 seconds and survival chances would be excellent. All of this makes for pretty sound reasoning establishing the 14,000-foot preset altitude.

The main point is for you to know your setting, and when you have to, use it accordingly. ▲

Answers to Quiz "Would You Accept This Equipment?"

1. Oral inflation valve open. 2. CO_2 pull tab not safetied. 3. Time and altitude improperly set. 4. OK. No seal required on automatic chutes. 5. Seal broken; canopy exposed. 6. Flares are missing. 7. Safety clip missing. 8. CO_2 cylinder missing. 9. D-ring hooked. 10. This chute is all right.

Survival by Accident

SLUGGER 21 and Slugger 22, two F-89Ds, took off from their Arctic air base to practice intercepts in the local area. The pilots were briefed to alternate turns at flying as target and interceptor aircraft. No sweat.

Separated on take-off, both aircraft were vectored by GCI on different headings five minutes apart to 1000 on top of the overcast. They broke out at 30,000 feet. No sweat.

On the first intercept, Slugger 21 acted as target. GCI vectored the intercepting Slugger 22 for a 90-degree beam attack. No sweat.

But the two aircraft were only seven miles apart when the Radar Operator in Slugger 22 finally got a lock on his target. Then, almost at once, the pilot in each aircraft found himself on a collision course with the other. And this is where the sweat begins.

"Go under, Jim, go under!" Slugger 21 called wildly to Slugger 22.

But Slugger 22 had a mind of his own. There wasn't time, he decided, to go under. He broke to the left, hoping to go behind and slightly above the onrushing Slugger 21.

"His right wing," Slugger 21 later reported, "clipped my right wing off about two-thirds of the way out, and we did a snap roll on contact and continued to snap.

"I tried to recover from the snaps," Slugger 21 continued, "but was unable to do so. I told the Radar Observer that we'd better get out and I blew the canopy. The right armrest would not come up. *I couldn't locate the safety pin.* My helmet would slide over my right eye as I craned my head to the right trying to find the safety pin; so I took my helmet off but it didn't do any good. I still could not get the pin.

"I elected to go over the side and on my first attempt I was blown back into the cockpit. Finally, with my feet in the seat and both hands on the right rail, I managed to get over the side to the inside of the spin. I hit some part of the aircraft but I don't know what. I got a light to moderate opening parachute shock. But I was greatly surprised when I found *I had forgotten to attach my survival kit to my parachute D rings.* I landed in a tree and because of the strong surface winds, had difficulty in getting out of my harness. I was rescued 15 hours later."

The Radar Observer in Slugger 22 never got out of the aircraft and was killed.

Slugger 22 had meanwhile gone into a spin, "preceded by two or three alternating climbing and diving snap rolls," the pilot reported. "Let's get out of here. Blow the canopy, Bill,

This is a story of a survival—by accident. Check off the slips you might have made, yourself. And remember, this is what happens when you forget the book and try to fly and survive on your luck.

The two aircraft were only seven miles apart when the RO got a lock on. Each pilot immediately realized that he was on a collision course. Here the sweat begins.

you blow the canopy!" he called to his observer.

"I tried," he continued in his report, "to squawk emergency but couldn't reach it because of severe G forces. But the canopy blew and I knew that Bill had heard me even though he made no transmission after the impact.

"I tried for three turns of the spin to fire the seat by pulling at the right armrest but I couldn't get it to the UP position."

Then the pilot of Slugger 22 also decided to go over the side. He too had trouble getting out. "I had considerable difficulty moving my hand to the lap belt buckle because of the G forces. When I did get the belt off I tried to go over the side but was blown back into the cockpit. During this attempt, I lost my helmet and gloves. Finally, I got my feet in the seat and jumped straight up. I think I hit the tail of the aircraft.

"My chute opened with a very mild shock, and for about ten minutes, I couldn't see. Before contact with the ground, I unbuckled my leg and chest strap and noted that my survival kit was attached to my chute. I landed in the trees and hung momentarily by my parachute, then dropped into the waist-deep snow. My hands were extremely cold and I had to use my teeth to unzip the survival kit.

"I found two trees and a large bush, and using the tarpaulin from the kit and a piece of chute, built a shelter. The snow was heavy and the wind was strong. The matches in the survival kit were safety matches and I had nothing to strike them on. Fortunately, I had other matches in my pocket or I would not have been able to build a fire. I placed the chute on

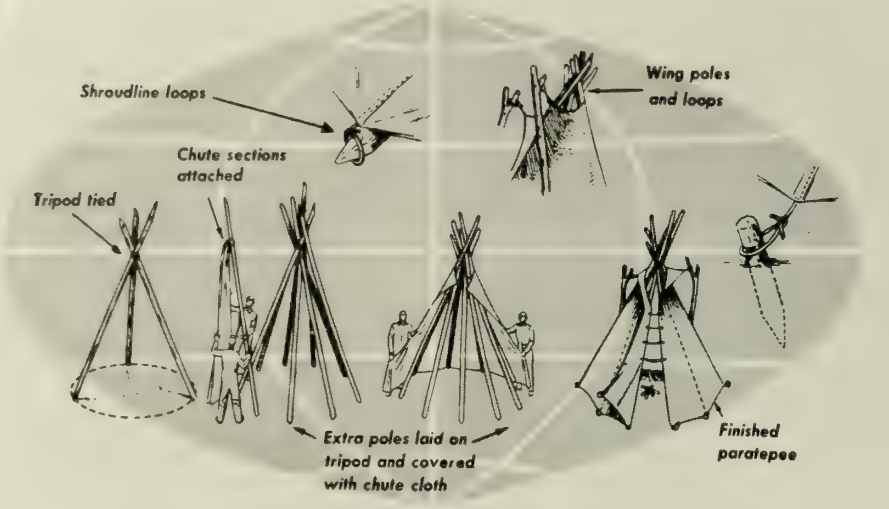
the ground in the shelter and put my sleeping bag on top of the chute. I changed socks, loaded the 22 caliber rifle, fired it once, put it in the sleeping bag with me and then went to sleep.

"At three o'clock the next morning, 13 hours after the accident, I heard a plane fly over. I leaped out of the sleeping bag, ran outside of the shelter and tried to fire a flare. I couldn't get it to fire before the plane was gone. The second time the plane came over I fired the flare and apparently the rescue team saw it, as a helicopter arrived in about 15 minutes and picked me up."

The Radar Observer from Slugger 21 had his own story to tell:

"At impact, my only statement was 'Whoops!' The pilot calmly said, 'What'd we lose?' I answered, 'Part of our right wing is gone . . . better squawk emergency.'

"When we decided to get out, the pilot blew the canopy and I raised the left armrest with my left hand and began searching for the armrest safety pin with my right hand. Just about the time I felt panic approaching, I located the pin and after some difficulty managed to pull it. The ejection was not abrupt and the force was not great enough to close the visor on my helmet. I believe my hand and the automatic lap belt release acted almost simultaneously. I pulled the ripcord almost immediately after releasing the lap belt and my parachute opened with a great deal less opening shock than I had expected. While descending, I noted that I did not



One man had never heard of a "parateepee" . . .

have my survival kit attached to my parachute. I had always left it unattached in case I had to make a rapid exit on the ground. . . . I'd never considered that I might not have time to attach it in flight if the need to eject arose.

"I landed on my left side and was dragged about 15 feet in the snow on my back. I was stopped by the stump of a bush which knocked the protective coating off my helmet and forced snow down my back. I collapsed the chute by releasing only one side of the canopy release as I did not want to lose the chute. After brushing the snow off, I made a shelter with part of the chute, converted the back pad of the chute into a warm cover for my feet, and settled down for the night, wrapped in the remainder of the chute. I was picked up by a helicopter about 15 hours later."

If you haven't been keeping the score, here's what happened. The primary cause of the accident, the investigating board determined, was pilot error on the part of the intercepting pilot in Slugger 22 in that he failed to take proper corrective action to avoid collision and did not follow the advice of his element leader to go under. Further, both pilots failed to follow squadron SOP in that they did not allow for vertical separation on the first intercept to insure that their radar computors were properly calibrated to provide lateral clearance. But that's not all.

In the use of ejection and personal equipment there were a number of glaring errors, the board stated. Such items as these were obvious:

- Failure to remove seat safety pins.
- Failure to attach survival kits to parachute D-rings.
- Inadequate inspection of survival kits, which resulted in the inclusion of safety matches but nothing to strike them on.
- Failure to fasten chin straps, resulting in the loss of helmets on bailout.
- The releasing of the lap belt by hand which rendered the automatic opening device for the parachute useless. (This may have contributed to the frost bite of one crewmember whose chute opened above 20,000 feet.) The automatic device would have afforded free fall to 14,000 feet.
- Ignorance of the crewmembers of the many emergency uses of the parachute for ground survival in the Arctic. One had never heard of a "parateepee."

Considering all of this, the survivors were lucky to make it. Two of them were lucky to have escaped from spinning aircraft without the use of their ejection seats — seats that couldn't eject because a safety pin hadn't been pulled. Two were lucky to last for 15 hours in the snow, without survival kits. Two had no helmets; one no gloves and one might have had no fire to warm himself except for the happy chance that he happened to have some other matches in his pocket. It's a sad story about an accident that needn't have happened in the first place. But it did.

There is only one good item in the whole long list of errors. Both Slugger 21 and Slugger 22 were equipped with chaff dispensers and the dispersion of chaff was painted on GCI scopes and led to the rescue of surviving crewmembers within a period of 15 hours. Here they were lucky too, for given another day and a night in the frozen snow, somebody's luck might have run out.

What's the moral? There's almost an even dozen here, beginning with don't forget to pull the safety pins on your ejection seat. But most of all, don't ever forget that it can happen to you. Remember this when you climb into your bird and the odds are pretty strong against forgetting anything else. ▲

Your Airplane Isn't Everything

Major Wallace W. Dawson
Fighter Branch, D/FSR

LET'S FACE IT. As aircraft fly higher, faster and farther, crewmembers' personal equipment becomes more and more important. To quote one of our rustic heroes: "As any fool can plainly see, your airplane isn't all you need to know, anymore."

Personal equipment is just about as old as the flying game itself, but like everything else, it has had to change with the times in order to keep abreast. For instance, a pilot would look pretty silly today, wouldn't he, mounting an F-100, dressed in puttees, riding pants, leather jacket and with his bill cap turned backwards?

No, today, the demands of our mission dictate the type of gear we will use and the way we will use it. Because of this, the picture changes constantly and sometimes we have to rush to keep up with the new stuff that's coming out. This is especially true for those jocks whose primary duty is flying an LSD (a large, steel desk).

There is a bright side to this picture, however. Not very far away are several people who are interested in your knowing your personal equipment and who are ready, willing and able to help you do just that. Along this line, periodic visits to the Personal Equipment Section can really pay big dividends. The next time you get the chance, stop in and spend a couple of hours with these people. I'll bet you'll learn something and, who knows, maybe some gloves *have* finally come in. And while you're there, ask the experts to check over your equipment and to give you the latest "poop" on any new gear that's out. They'll be more than happy to answer your questions and will help you all they can.

Of course, they can only go so far towards keeping you safe and comfortable while you're flying. The actual preparation for flight and the proper use of your gear is up to you. A lot of time and money have gone into the gear that you wear in flying today.

It has been said, and rightfully so, that familiarity breeds complacency. It is only natural for a fighter jock to trust his bird. He has probably flown it hundreds of times without any serious trouble and expects to continue flying it . . . that way. This is when *care* and *handling* of personal equipment can suffer. 'Loosen that chute harness a little so it will be more comfortable.' 'No need to wear gloves, baby, it's hot outside.' 'And that Mae West—leave it in the locker—this flight is over the desert.'

Yes, these things can and do happen even though they shouldn't. And then if the red light comes on sometime and you are faced with an emergency, you may not be ready.

Why not make like a Boy Scout? Besides helping old ladies to cross the street, he is "prepared." This can get real important because as our mission requires higher and faster flight, it also requires operation of our equipment at maximum efficiency. Airplane parts have failed in the past and might even do so again. If this happens, it just might be necessary to resort to a nylon descent and you may not have any time to spare.

Your personal equipment is tip top—the best in the world. Experts have been provided to show you how to use it and how to keep it in the best possible condition. All you actually have to do then is to learn to use it right and to use it that way.

After all—the life—well, it may be your own! ▲

Are YOU Ready?

Physical, mental and psychological factors can have a direct bearing on performance. What with checklists for everything else, here is a personal one for you.

Jeff Sutton, Research Engineer
CONVAIR, San Diego

ONE OF THE earliest devices for checking the presence or absence of an item, or the degree to which it possessed a given characteristic, was the checklist. This simple device, properly used, can still be a pilot's best life insurance. Pilots recognize its value in checking out their aircraft and flight plans. Its use is a must—or it should be—even if you are just flying to the corner grocery. Then, why not a checklist for the most variable component you have to cope with—your own flight readiness?

For use in such a checklist, your flight readiness, or well-being, is defined as your physical, mental and (especially) psychological (emotional) fitness to operate an aircraft during the full time you propose to be airborne. This means your ability to attend instruments and respond quickly and accurately to all operational demands. Your judgment, decision-making processes, accuracy of response and reaction times are the chief areas involved. These are the areas where you have to be sharp—at peak condition.

This is especally true if you are jockeying one of the Century series hotrods where closure rates are fantastically fast and decisions arise by the bunch. It is also true if you are in the heavier hardware where flight routines are long and monotonous, and even the fresh starter ends up fatigued. Yet it is in precisely these areas that performance decrements first set in—often long before you are aware of them.

Such impaired performance may take the form of something as seemingly simple as the misreading of a dial, a misjudgment of distance, failure to perceive a warning signal or undue length of reaction time. Yet, these are the raw materials from which accidents are made. Such goofs are not simple discrete occurrences. They are signs that deterioration of performance already is well along in its course. They say, "Beware!"

No practical checklist could serve to examine all the danger areas exhaustively. It would take a staff of physicians and psychologists to do that. But it can present pertinent questions which will give you a pretty good idea of what kind of performance you are capable of. If the shaky variety is indicated, that's your cue not to fly. It's easy to rationalize by saying, "It's just a short hop." Well, it might be shorter than you think.

The value of such a checklist is directly proportional to the care taken in its construction. It must be short enough to be readily usable, yet include the major factors which have a bearing on flight performance. These latter are physical, mental and psychological states which adversely affect your ability to fly even though you may not be aware of them.

The main trouble areas have their genesis in prior dissipation, lack of sleep, sustained concentration, prolonged flying time without adequate rest, excessive time on instruments and abnormal environmental conditions, all factors ensuing from flying itself. These are natural precursors to impaired performance. But so are such commonplace things as mother-in-law troubles, balancing-the-budget headaches, or the accumulation of all the common distractions that mark everyday life. Your son's penchant for throwing rocks at the neighbors' windows can have direct effects in your undershooting or overshooting on the letdown, or your failure to let down your landing gear.

In aviation the results of such irritants customarily have been gathered under the all-inclusive word *fatigue*. This catch-all category includes the common garden variety of muscular fatigue (caused by prolonged or difficult physical exertion), mental fatigue (caused by sustained concentration, difficult mental tasks, or the effort required in monitoring a number of mental tasks simultaneously or in quick succession) and psychological fatigue (which arises from fear, worry or any prolonged emotional binge).

In turn, the fatigue syndrome has direct and adverse effects on performance which have been measured many times. These include:

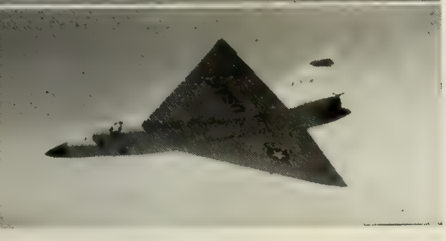
- Increasing energy requirements to perform a given task.
- Increasing variability and error in manipulating controls, reading gages and estimating distances.
- The acceptance of increasing tolerances in all aspects of operational flying.
- Increasing reaction time.

Do you ever find yourself concentrating unduly on one instrument at the expense of others or neglecting your peripheral instruments?

Or, do you find yourself making the right actions at the wrong times or over-controlling your aircraft? That, too, is fatigue. Oddly enough you may feel right in the pink at a time when your performance is sadly on the skids. That's the insidious thing about fatigue. It does not announce its arrival. The value of the checklist lies in pointing out the little cues that tell you when such operational effects are apt to occur. It tells you when to keep your feet on the ground.

However, if you are fatigue-wise, you will recognize the subtle and not so subtle signs which mark its onset and hark to their warning. It is these signs which form the basis for the suggested accompanying flying safety checklist.

They are not all-inclusive. They do not, for example, cover health con-



CHECKLIST FOR FLYING SAFETY

TEMPORARY FATIGUE SYMPTOMS

Physical Fatigue

- Physical Exhaustion
- Increased Effort to Carry Out Work
- Increasing Rate of Error in Operations
- Tenseness in Major Body Muscles; Stiff Neck; Tremor
- Tendency to Doze; Need of Sleep
- Feeling That You're "Not Sharp"

Mental Fatigue

- Unusual Difficulty to Follow Instructions; Things Hazy
- Need to Re-check Your Actions; Uncertain About Decisions
- Diminishing Range of Attention; Deterioration in Judgment
- Accepting Greater Tolerances in Instruments and Controls
- Accepting Unnecessary Risks

Psychological Fatigue

- Vague Headaches
- Increased Startle Response
- Tendency Toward More Frequent Sighing
- Irritability, Fault-finding, Impatience, Temper Flareups
- Unusual Preoccupation; Forgetfulness
- Sense of Discomfort; Failure
- Boredom, Loss of Motivation, Lack of Group Interest
- Tendency to Carelessness
- Inability to Concentrate

CHRONIC FATIGUE SYMPTOMS

Physical, Mental and Psychological Fatigue

- Increased Reliance on Coffee, Tobacco and Alcohol
- Loss of Appetite
- Loss of Weight
- Social Withdrawal, Resentment Toward Others
- Nonconformity, Asocial Acts
- Decreased Personal Cleanliness
- Insomnia, Nightmares, Radical Change in Sleep Habits
- Confusion, Chronic Anxiety, Fearfulness, Depression
- Vague Chest Pains; Difficulty in Breathing
- Vague Visual and/or Auditory Disturbances

ditions which arise from physiological malfunctioning. But they do cover most of the symptoms of temporary or chronic fatigue which effect performance. And right here is the place to put in another pitch. If you have any health problems or suspicions of such or are chronically fatigued, pay a fast call on your flight surgeon. That's what he's there for.

You will note that the checklist for flying safety has a four-way breakdown: temporary fatigue symptoms that are physical, mental and psychological in origin, and chronic fatigue symptoms in all three areas. The method of classification is chiefly for convenience, inasmuch as these symptoms often cross party lines.

For example, "tenseness of major body muscles," shown as a symptom of physical fatigue, can just as easily mark psychological fatigue. Also, some of the symptoms classed as "temporary fatigue" are also prominent in chronic fatigue. The kind of fatigue is not as important as the fact that it is present.

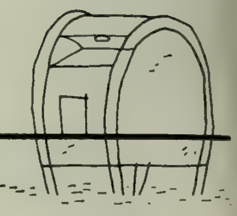
Fatigue is generally classified as "temporary" if it can be eliminated by a good night's sleep. If you have any of the symptoms listed under the last category (chronic fatigue), then the flight surgeon most certainly is your man.

One last word about the checklist: The presence of one or more of the symptoms listed doesn't necessarily mean fatigue. Conversely, passing the checklist with flying colors does not guarantee that you're in super shape. But the checklist does indicate when you should see your flight surgeon. The safest course is to check periodically with him, and check without fail when any disturbing symptoms are present. In the case of aircrew, disturbing symptoms often are disregarded in the interests of preserving flight pay. The specter of being grounded is unpleasant — but to fly when you should be grounded is the height of false economy. In the heavier hardware, crew performance is measured by its weakest link.

You can construct your own checklist, following the advice of your flight surgeon, or you might like to keep the accompanying checklist for handy use. A handy-dandy checklist that is never consulted is about as valuable as an all-lead glider. But if your checklist is carefully constructed and used before each flight, the dividends it pays may be the saving of your life. That's quite a bonus. ▲

CROSS FEED

LETTERS TO THE EDITOR



In Australia

This is an inquiry about getting on the mailing list for FLYING SAFETY.

I am a USAF officer on exchange duty with the No. 82d Bomber Wing, here in Amberley, Queensland, Australia, until May 1958. I am a senior pilot and I feel rather left out of current USAF procedures, since being at this far-removed assignment. If I could receive FLYING SAFETY I feel that I could at least keep abreast of present procedures and trends. The Australian officers assigned to this wing would literally wear out the publications since the RAAF does not publish a similar magazine for service consumption.

Would like to be advised if the magazine can and will be mailed to me without charge.

Major Larry W. Smith, USAF
Exchange Officer

You're on the list, Smitty. Sorry, we can't do the same for your Aussie Compadres. But we're still taking subscriptions.

★ ★ ★

Faulty Perception

Bouquets to you for passing the word on illusions of perception and how pilots can avoid or effectively combat these phenomena. (I refer to the article, "Deception Rides the Skyways" in the June issue of FLYING SAFETY.)

During the past four months, this command has experienced two major aircraft accidents that were caused by faulty pilot perception and, in one instance, the pilot became hopelessly disoriented, and crashed. Although your article was too late for these pilots, it will serve to educate the rest of us concerning this vital aspect.

Regarding Lt. Col. Harry N. Young's letter to the editor, also in the June issue, I'd like to point out that many ARTC's seem to have a penchant for assigning IFR cruising traffic altitudes that are not in accordance with an appropriate VFR altitude for the direction of flight. Admittedly, this practice does not violate any regulations and is a valid practice in expediting traffic; however, it does set the stage for mid-air collisions between aircraft not operating under the same rules.

I suggest that the CAA should carefully re-evaluate this practice to determine what justification exists in creating a high risk potential for the sake of expediency. For my part, I won't accept "inappropriate" IFR altitudes. Sure, I'm delayed at times . . . but it's a comfortable delay.

Capt. John Y. Harris
Hq 4AF, Hamilton AFB.

Delay is often cheaper and a darn sight more comfortable. If you can't wait, keep a sharp eye going for you.

★ ★ ★

That Green Apple

While reading the May 1957 issue of FLYING SAFETY, I was particularly interested in the article "Just a Triggerman." I noticed that whenever you mentioned the automatic release arming knob, you referred to it as the "green apple." Any automatic release that I have ever encountered had an orange colored knob with a white luminous strip around. Could it be that you were confused with the pull cable knob on the bailout bottle which is green in color and round like an apple? If someone were to bail out and pull the "green apple," a 10-minute supply of oxygen would be had. But, O-O-O-OH, that ground is hard.

Please advise me if I'm wrong.

S/Sgt. James L. Mercier
Personal Equipment,
1002d IG GP, Norton AFB.

It Should Be Red

The article "Just a Triggerman" in the May issue of FLYING SAFETY has been reviewed with considerable interest and is considered a step forward in a field where crewmembers have received a minimum of briefing. There are two points, however, which must be clarified:

1. The altitude setting for all automatic parachutes has been established at 14,000 feet.
2. The "green apple," mentioned, when pulled, will operate the Type H-2 oxygen bottle and not the parachute. This reference is misleading and can lead to serious consequences. The automatic ripcord release is actuated by pulling a red plastic knob called the "arming knob." A luminous strip embedded in the knob permits visual location in the dark.

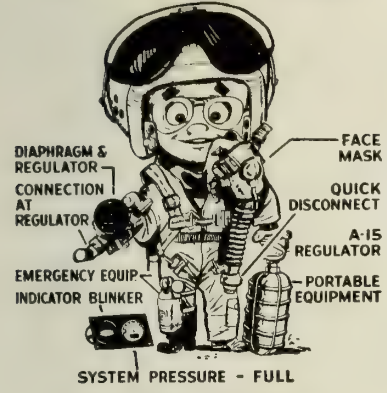
This Branch will continue to follow FLYING SAFETY avidly and hopes that more space can be devoted to personal equipment and escape problems in future issues.

W. P. Shepardson
Chief, Parachute Branch
Equipment Lab, WADC

The "green apple" referred to has certainly given us the bellyache. Seriously, this was a goof on our part and should have been caught by proofreaders. We hope our readers are aware that the arming knob is actually reddish orange in color with a white luminous stripe.

See "Those Shocking Altitudes," page 18 for the latest word on automatic opening chutes.

Little Logic says..



"P. D. McCRIPE"

Courtesy Lockheed Aircraft Co.

Oxygen Mask Test

Here's a bit of information that might be of interest and value to other flying organizations and perhaps worthy of space in FLYING SAFETY.

In the past (to the best of my knowledge), no single, readily accessible apparatus, other than the aircraft itself, has enabled flying personnel to test oxygen masks and headsets. Malfunctions in these two items have thus rarely been discovered prior to a crewmember's entering the aircraft to perform his preflight inspection. Granted, these are both dependable pieces of equipment, nevertheless, like people, they are subject to occasional failure.

To provide flying personnel of the 9th Bomb Wing with a facility for testing oxygen masks and headsets, a singly enclosed device was designed, constructed and installed in each of our squadron's personal equipment section. Our so-called "Mobile Oxygen Mask and Headset Test Stand" is a wooden cabinet containing a pressure-demand oxygen regulator, a low-pressure oxygen cylinder, a small easily-built radio set and jacks for both high and low impedance; material for mask cleaning and instructions for its use.

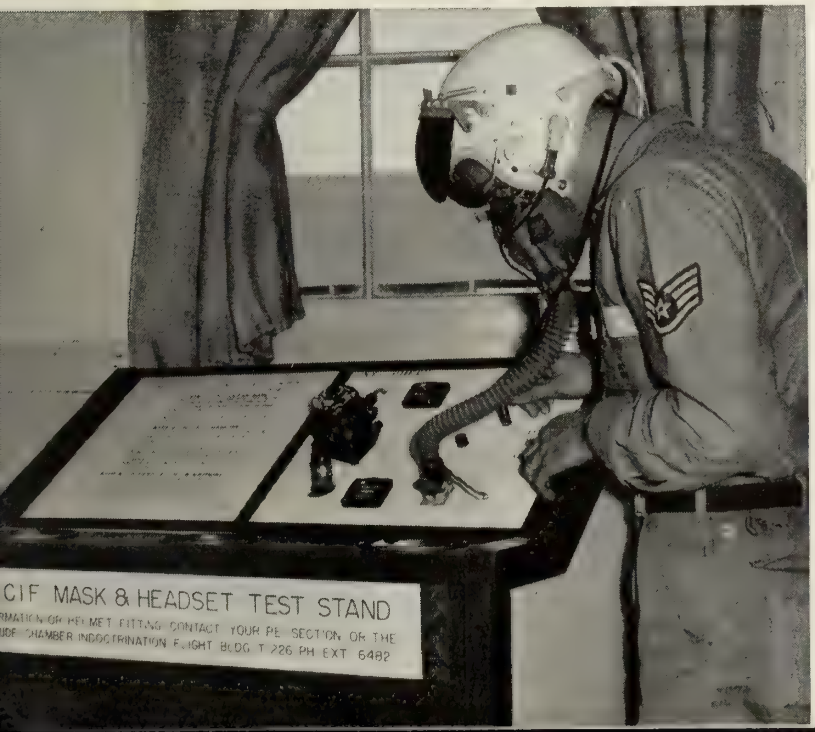
The crewmember takes the gear which he draws from Personal Equipment, to the Test Stand and checks his oxygen mask, mike and headset before proceeding to his aircraft. By having it checked here, first, he won't have to return to Personal Equipment from the ramp, should any part malfunction.

He may also prevent the possibility of having to abort a mission.

In the event this information warrants magazine space, it might be mentioned that a diagram of the radio set and a plan of the test stand can be made available to any interested outfit by writing to our unit. The photos show three of the installations made, to date.

Capt. Robert B. Yandell
Commander, 1st Alt. Ch.
Indoc. Flt. 9th B-Wg(M)
Mountain Home AFB, Idaho

Good show! Another case where some guys don't wait for the silver platter treatment. The rig is great, but don't forget to preflight the airplane end of the equipment, as well.


CIF MASK & HEADSET TEST STAND

UHF Switch

I have just read one of your items entitled "Rex Specials" in the May issue. The last paragraph states that by positioning your UHF Switch in the Tx/Rx plus guard receive position will allow the radar controller to override any transmissions by the pilot in the event control instructions are a must.

In the case of the very common RT-178/ARC-27, if the pilot is transmitting with switches positioned as above, he cannot receive on the guard receiver or the main receiver because the common antenna is switched to Tx section only of RT-178 by relay K-1401.

Reference to this can be found in 12R2-2ARC-27-2 (Handbook Service Instructions) page 60, Sec IV, Par 4-66.

T/Sgt. John Johnson
68th A&EM Sq, 68th Bomb Wg (M)
Lake Charles AFB, La.

Slips. The man is right.

★ ★ ★

The C-45H

On page 26 of the May issue, the article entitled "Flying the C-45H," states: "Let the nose tanks run dry." "And they have been known to never catch." Please relate specific instances.

If you can't get an airstart in a C-45 after running any given tank dry, some old, bold C-45 pilots are in for a rude awakening. It has been a practice to run C-45 tanks dry in order to determine exact fuel consumption and hence information concerning remaining hours to fly. Fuel gages have proven to be somewhat unreliable when they approach the empty side of the dial. Determining exact fuel consumption and exact remaining fuel can make a great difference in the safety of long range planning.

Now then: If you contemplate a future article on C-45 aircraft, some reference to mixture control settings could be of value to FLYING SAFETY's readers. The C-45, with mixtures in rich position, will fly slightly longer than a T-Bird before flaming out. By leaning the mixtures judiciously, you can get over seven hours out of it and help the Air Force save money.

Maj. Gordon J. Andrews
1727th Support Sq. (Trans)
APO Seattle, Washington

REX SAYS

IN REVIEWING the replies to questionnaires completed by 132 pilots who had ejected successfully from the F-86, '101 and '102 aircraft during 1956, it was amazing to note how many factors were common to all. These ejections occurred at altitudes varying from 800 feet above the terrain up to 39,000 feet, and at speeds varying from a stall to 525 knots, yet the factors remained fairly constant. They read like this:

- When the helmet chin strap was not fastened, the helmet and mask were usually lost. Therefore the chance of retaining the helmet and mask is greatly enhanced if the chin strap is fastened and the visor is down.
- All pilots ejecting successfully had removed the armrest safety pin prior to the emergency.
- The majority of pilots receiving cuts on the head and face, had not fastened their oxygen hose connection to their parachute chest strap in prescribed manner.
- Those pilots having difficulty collapsing the parachute canopy on landing were not familiar with operation of the parachute canopy quick release.

Most of the injuries sustained on landing occurred when the pilot hit the ground while drifting with his back to the direction of drift. Many also stated they were unable to turn themselves in the chute and could not judge their height above the ground (resulting in hitting the ground when they thought they still had another 100 — 200 feet to go).

You will probably say, "So what? This has been known for years." True, it has been. But there's nothing like actual experience to prove recommended procedures. And these ejections were "for keeps" and not service testing or the like.

When the time comes to eject, there seldom is time for pin-pulling, chinstrap fastening or studying the operation of the parachute canopy quick release. These are things you must have done and/or be familiar with. And the procedures in the Dash One aren't just educated guesses of the manufacturer. They more than likely came the hard way — that of crewmembers having to eject and then giving us the benefit of their experiences. We can hardly afford to ignore them.

REX SPECIAL

EVER HEARD of P. D. McCripe? Sure you have. Everybody knows that P. D. McCripe is an oxygen checklist, but if you are the average Air Force crewmember, you don't use this list because you consider it too long, or as one pilot said, "I can't even remember what the letters stand for."

Operational safety surveys conducted during 1956 failed to reveal a single crewmember who consistently conducted the check. Why? Because they erroneously felt that it really wasn't necessary to check all the items included in the checklist. So much emphasis has been placed on a proper fitting helmet and mask and the importance of cleaning the mask every 30 days that crewmembers are inclined to forget about the rest of the oxygen system.

What good does it do to have a proper fitting mask if the regulator is shot? Or if the hose connection to the regulator is leaking? The answer is obvious.

Oxygen discipline is a must in any aircraft; it is of vital importance in fighter aircraft where the pilot is alone or at least inaccessible to other crewmembers inflight. It is seldom that one hears of accidents caused by hypoxia in multi-place aircraft, for the copilot or navigator can always get to the pilot if he passes out or begins to act "peculiar." The single-place aircraft pilot, however, either regains consciousness or else. Often it is "Else."

Actually, pilots do check most of the items included in the P. D. McCripe checklist; however, they do not perform the check in any systematic manner and this leads to forgetting or overlooking critical items. Take a look at ol' P.D.:

P — Pressure and quantity gage.
D — Diaphragm of regulator (blow back test).
M — Mask (condition, leaks, valves).
c — Connection to mask (quick disconnect).
C — Connection at regulator.
R — Regulator.
I — Indicator (blinker).
P — Portable unit (multi-engine aircraft).
E — Emergency bailout cylinder.

Is it to long or too difficult to remember? Not if you use it a few times and conscientiously check each item. If you check most of these items anyway, why not do it by a mnenomic checklist rather than by a haphazard guess. Odds are that you'll be less likely to overlook an item. ▲

LOOK WHO'S LEAPING

Just goes to show that you never can tell who's going to be next. Take a tip from Kay Reid and get acquainted with those finer points right now. You'll find the word of an expert in the story beginning on page 2. Could be your turn.

"Equipment's fine," we heard Mal say,
As off he roared on merry way.

But things go awry in the sky,
And Mal's got problems you can't buy.

The dinghy goes when it ought not,
And on the canopy he is caught.

But he's in luck with all his woes,
He's got the handle with his toes.

His trouble's his own—we hate to nag,
He should've looked at Inspection Tag.

*U. S. GOVERNMENT PRINTING OFFICE 402045

.1305
S

FLYING SAFETY

UNITED STATES AIR FORCE

SEPTEMBER
1957

THE LIBRARY OF THE
OCT 1 [illegible] 195[illegible]
UNIVERSITY OF ILLINOIS

MAINTENANCE TODAY

File Thirteen

I can hear it now: "Maintenance talk in FLYING SAFETY?" You bet. Our whole theme this month is just that—Maintenance Today. And with good reason. Time was when a pilot just sort of flew what he got, with no questions asked. He flew 'em; somebody else maintained 'em. The pendulum has swung and now the pilot finds himself a hand-to-hand partner in the matter of keeping his bird reliable and ready to go. Hence our cover design, denoting the necessity of meshing air and ground crewmen into one unit to achieve their common goal. . . . Word comes that some bases are dragging some feet on runway distance markers. Some have none and others have inadequate markers—like numbers that are too small, unlighted or in such poor state of repair that they are difficult to read. Your Flying Safety Officer received all the latest specs last month. . . . The hot weather is beginning to show up in "settled back onto runway with gear up" accidents. It's difficult to understand how a pilot who has realistically computed his takeoff distance requirement, can pull his bird off before he ever reaches his computed distance. . . . Flew with two pilots on a clear-across-country IFR flight the other day. Neither had heard of Channel 13 nor were they familiar with Pilot-to-Forecaster Service. FLYING SAFETY (Feb 57) carried the story. The stations are listed in the Radio Facility Chart as PFSV. . . . Your FSO has some good poop on the hazards of flying through Severe Weather Warning Areas. They're still around.

'til October,

Vernon R Stutts

Have You Ordered a Personal Copy?

Superintendent of Documents
U. S. Government Printing Office
Washington 25, D. C.

Please send Flying Safety Magazine for one year to the following address. Enclosed is a check or Money Order for $2.50. ($3.50 for foreign mailing.) Catalog No. D-301.44.

Name____________________

Address____________________

City__________ State__________

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Major General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base,
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Editor
Major Vernon R. Stutts

Managing Editor
Major James W. Bradford

Art Editor
M/Sgt. Steven A. Hotch

Production
Major Ben H. Newby

Editorial Asst.
Amelia Askew

Distribution
T/Sgt. William H. Johnson

CONTENTS

Trend of the Turbine 2
How Well Can You Remember? 7
Operate to Maintain 8
PIP for Pilots 12
Splash Department 14
Shoot Yourself Down 16
One for the Record 20
Rex Says 24
Up or Down 26
Crossfeed 28

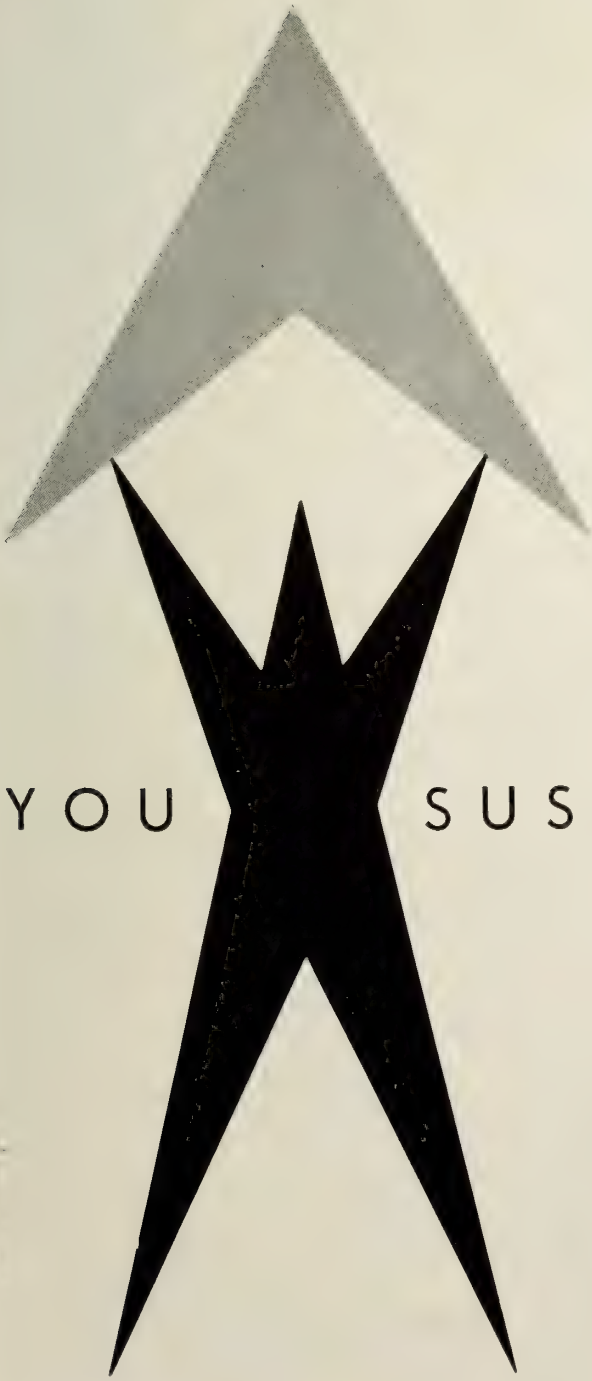
VOLUME THIRTEEN NUMBER NINE

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D.C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished.

Use of funds for printing this publication has been approved by the Secretary of the Air Force and the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the *Flying Safety Magazine*. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, *Flying Safety Magazine*, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use of material. Such action will insure complete accuracy of material, amended in light of most recent developments. The contents of this magazine are informational and should not be construed as regulations, technical orders or directives unless so stated.

USAF PERIODICAL 62-1

YOU SUSTAIN THE WINGS



Times change, for better or for worse. The inexorable march of scientific progress makes many lovely things obsolete. The wonderful old Air Corps has taken its place in the museum of nostalgic Americana alongside the Mississippi sternwheeler and the open-top Fifth Avenue bus.

We still have a mission to accomplish—more important than ever. Our airplanes still make a loud bang when they hit the ground, but the really loud noise you hear is the terrific impact on the national debt. Also, with all our progress, we still like to stay alive. So, some things don't change and we still have the job of keeping 'em flying.

When an airplane is built in this day and age, it is capable of performance perilously close to its design limits. The old cushion against the extremes of time, speed, temperature and structural stress is not as fat as it used to be. Our new birds are finely tuned instruments that will do wonders for us if we treat them exactly right. But let's not forget, they're not the forgiving machines some of the old ones were. They don't turn the other cheek when they're abused. Is this bad? Of course not.

In the good old days, a crew chief could keep his airplane flying with a roll of piano wire, a couple of yards of fabric and a can of dope. Flying the crate was comparatively as simple.

But fifty years of progress has brought aircraft approximating missiles, with a scarcity of wing area and highly dependent upon engine thrust for safe landings. The complicated electrical and hydraulic systems place greater demands upon the pilot and the maintenance crew than ever before: for one to understand and to fly, for both of them to maintain.

It all boils down to the fact that today's pilot must be a professional. He must operate his aircraft with finesse and precision and get maximum performance out of it without abusing the airframe or engine. He affects the workload of his maintenance unit directly by his manner of operation, just as he affects the reliability of his machine. A maintenance unit continuously changing engines, brakes and tires, as a result of some pilots' thoughtless "unfair wear and tear," has less time to spend on preventive maintenance. And—the pilot winds up sitting on the powder keg. It's largely up to you.

Trend of the

"FROM PILOT to pencil-pusher—that's what this Air Force is doing for me," Lieutenant Smith grumbled, as he came in the door of his Wherry Housing apartment. He brushed past his wife while still muttering, "Charts, curves, eyelids—just give me a plane!"

She watched him disappear into the bedroom and decided, "This calls for Special Treatment B." When he returned to the living room, freshly showered and dressed for comfort, she ceremoniously led him to his favorite chair, propped his feet up, and put a very dry, very cold martini in his hand, and passed him a plate of sardines on hot buttered toast.

"Partake," she instructed, "and then tell!"

Lieutenant Smith was a new F-86D pilot. He was also relatively new to the Air Force, the Wing, and to his bride. He told.

"All my life I've wanted to fly. I have trained to fly. The Air Force says I can fly. There is a lot of trite corn about the wild blue yonder but it's trite because it has been true for so long. I come zooming in home, monarch of all that I survey—yet I don't even get out of the plane before I have to start shuffling papers . . . checking oil pressure; there are guys crawling all over the plane measuring how much oil I'd used (down to the fraction of a quart), another fellow clocking my coast-down time and measuring my eyelids."

"Did you tell them that you have 20-20 vision?"

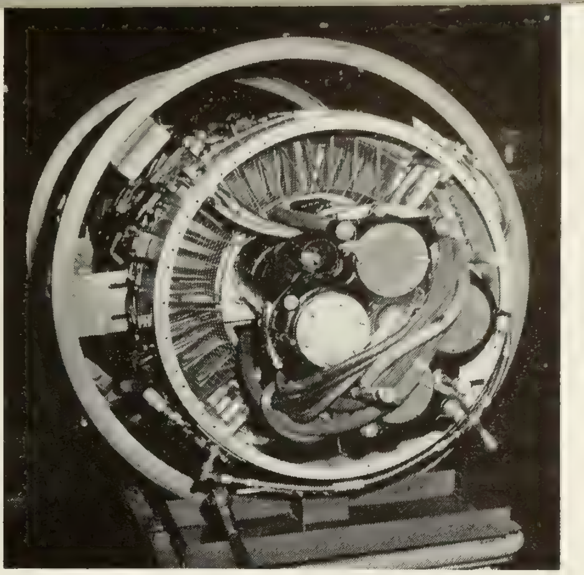
"This, pet, is a gadget in the rear of the plane known as the nozzle eyelid opening."

"Maybe they're checking its dilation to see how exciting the view has been?"

"Oh, come off it! You just don't understand . . . and I don't either. All I need is a plane that burns and turns. I'll fly it; let the other guys keep the diaries."

"There's probably a very good reason for it all," his wife suggested.

Turbine



Now, as never before, the pilot influences the type of maintenance his aircraft will receive. To the degree that he checks and reports, he will influence the reliability of his machine.

"Yeah, they said over in Ops that I'd get briefed on it, meantime I was to see that I turn in the right information. If I wanted to sluff off, the crew chief wouldn't let me. He's a stickler. We even do rechecks if something doesn't look right. Somebody made a believer out of him."

"Tactlessly changing the subject, we're eating early tonight. Our neighbors, Major and Mrs. Jones, are coming over for cards. He's a Maintenance Officer, I think. She came over this morning to see if we are getting settled all right and to invite me to a luncheon. So I asked them over tonight."

The Smiths and the Joneses were between deals at bridge later in the evening when Major Jones made a routine inquiry about the Lieutenant's job. Jones concluded an affirmative, enthusiastic reply with "The plane and I are downright congenial, but I may have trouble with my pencil."

"He came in flipping about measuring this and that; oil and eyelids, and coasting down and paper shuffling," Mrs. Smith contributed.

"Oh, that's the Engine Trend Analysis Program you're recording data for. It's a big accident-prevention deal. Going world-wide in the Air Force now. Whatever else you do when you get those figures, get them right! You are very enthusiastic about your flying," the Major continued, "and that's all to the good. That's what we want. But there are a lot of us who are equally enthusiastic about your coming back down that runway—home—too."

"Well, sir, I am at the head of that list. Besides protecting the Air Force's investment in me, I have become rather fond of my own neck. But so far, I don't see how more paper work will save me. You have a good Maintenance squadron to keep the plane in condition. Why bring pilots into the picture?"

Pilots Needed

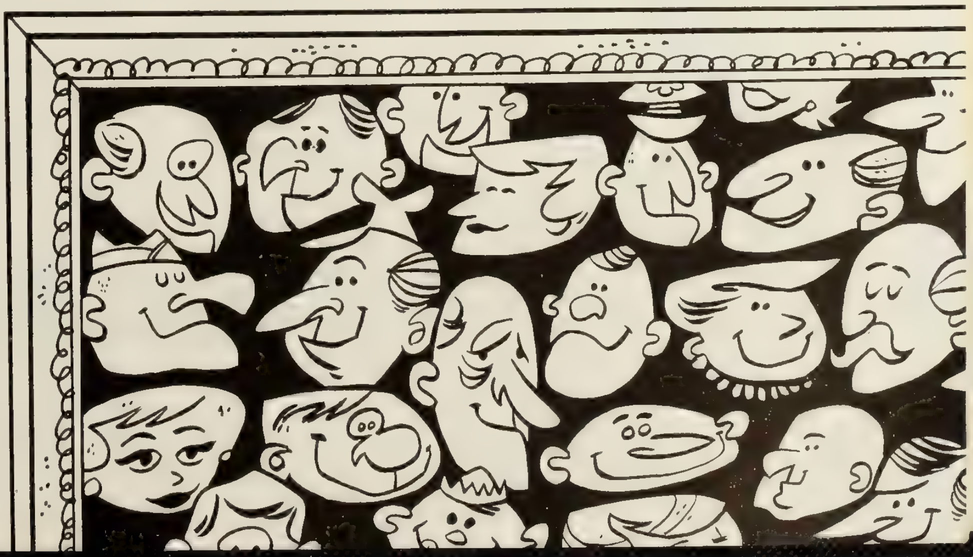
"Everybody's in this picture," was Major Jones' reply. "We have a world-wide Air Force with a primary mission of being combat ready. That means we also have long supply lines that must support operational aircraft. We need ready engines in war reserve instead of in overhaul or splashed over the terrain. We need you pilots; we don't consider you expendable. If we have all this, it comes down to one thing: We need engine reliability. One way to get this is to detect an impending engine failure before it happens, remove and service it, and put a 'well' engine back in your plane.

"That's where the Engine Trend Analysis Program comes in and where strict records of performance data take on greater importance. Major Brown, over in Records, takes all of these coast-down, oil consumption and pressure, and variable nozzle position figures and plots them on individual graphs for every engine. Each new entry that he makes on these graphs from records on every flight that you make, establishes the direction of a curve on the graph. If the curve rises or falls too much, it tells him that the engine is headed in the wrong direction. Then he tells me and we pull the engine to find out what's wrong. This statistical analysis is no crystal ball or ouija board that spells out 'You've got a bad bearing.' It does flash a warning to us and we pull the engine before it fails inflight."

"Look—are you fellows going to play bridge, or are you going to talk shop all night?" Mrs. Jones asked.

"Roger," Major Jones apologized. "I see the answer to a lot of his questions in your magazine rack. Have you read your July issue of the Maintenance REVIEW? It's required reading, you know, because it has an article in it entitled 'Dr. USAF and the Ailin' Engine' on this Trend Anal-

"Suddenly, there are guys all over my airplane—inspecting, checking, measuring. . . ."



ysis Program. You read that tonight, Smitty, and come to see me in the morning. I think I can show you how this paper work helps to keep you flying. Whose bid is it?"

The next morning, Lieutenant Smith had his Maintenance magazine with him when he called on Major Jones. "I'm still reading it," he reported. "It takes a little concentration. I can see that it's a good thing—and a big thing. I can see that my checkups, accurately made, start the ball rolling and I can see how the figures get onto a graph and how the graphs can be analyzed. I can even see where you maintenance fellows can follow a trouble-shooting chart. But it still looks like a maintenance job. Can't these things be caught in a routine crew chief checkup?"

"He can catch a lot of things. But, in the first place, it would take a guy whose mind was a cross between a camera and an encyclopedia to remember individual engine performance on all the engines and all the planes. And that's what we've got to know. The main reason he can't spot a lot of these deficiencies though is that the actual physical factors causing these pressures, times, rates and positions to vary from normal, are too well hidden for routine checks to reveal.

Coast Down

"I pulled this coast-down chart this morning to show you. I thought it might interest you because the engine was in your plane yesterday AFTER we pulled it and serviced it—then returned it to the aircraft. We pulled it for one reason alone. Analysis of this graph showed that the engine was in trouble. We didn't know exactly why, so we pulled it and found out. This graph is a record of the coast-down time. You've probably learned from the article that it should never take less than 65 seconds or more than 90, for your engine to coast down from 65 per cent rpm. As you can see, this plot shows that the engine was taking less and less coast-down time. When it reached the danger point, we pulled it."

"Yes, sir, I get all that, but how do you figure low coast-down time means trouble?"

"The time it takes a jet engine to coast to a stop from idle RPM is strictly a measure of friction. As the time goes down, the amount of friction inside goes up. This simply means that something is grinding or dragging in the engine. The parts that cause this are difficult to spot before they go completely out.

"When we pulled the engine which you flew yesterday, we found that the starter generator bearing was on the way out. It hadn't gone quite far enough, however, for the pieces to pass into the compressor.

"Do you know what would have happened if it had got there? No, I can see that you don't. The compressor would have come unglued. Now, do you know what would have happened then?"

"Yes, sir. If I had been lucky, I would have had a very flashy takeoff and odds are—on takeoff or upstairs—my flying career would take a sharp jolt, and Uncle Sam would be minus another plane . . . and I'd have had to walk home."

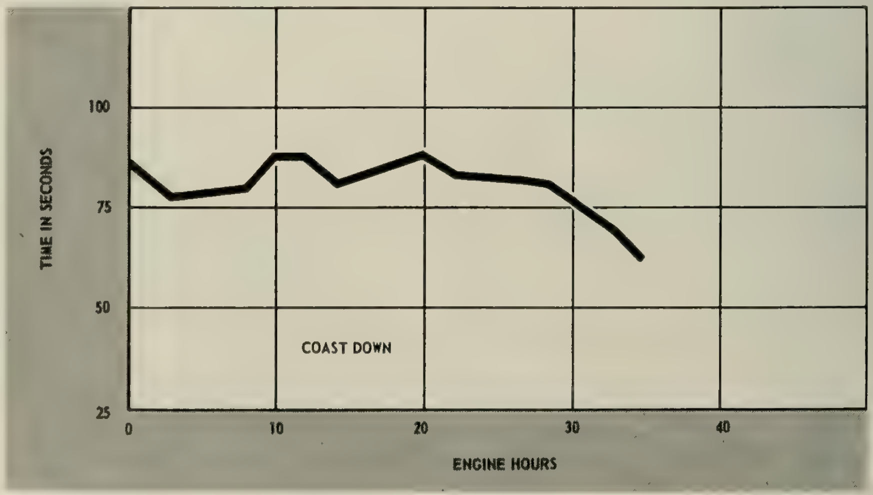
"Agreed. And to answer your first specific question, if you hadn't supplied regular, accurate figures for Major Brown to plot and analyze, we wouldn't have known that the engine was in trouble. He notified us in time to prevent an accident; without this analysis the only notification would have been to the Accident Investigation Board and possibly to the next of kin. That's the whole point of this analysis program—to learn to recognize when an engine is in the early stages of deterioration and to remove it for preventive maintenance, rather than to have it result in untimely inflight destruction."

"I buy off. How about showing me some more? I'll join the 'briefing' team for anybody else who has any questions."

"Okay. Let's take a chart on oil consumption rates. The rate of oil

". . . Another chap clocking coast down."

Is your engine headed in the wrong direction?



consumption in any engine is one criterion of its performance. When an automobile starts to drink oil, you begin to think about getting it corrected. Similarly, when the rate of oil consumption in a jet engine progressively increases or decreases, it also is significant.

‘If this oil consumption on the F-86D falls below 0.10 quarts per hour, or rises above 0.75 quarts per hour, it means, again — something within the engine is wrong. Find it. Further, when an oil consumption graph shows a sharp rise or drop over the last reading, although it does not specifically indicate a trend, it announces that the engine is in trouble. This particular chart shows a progressively decreasing consumption. Now, you might say that if an engine isn't using oil, it is a real fine engine—except that isn't the way it is.

"Your engine has a certain expected consumption rate and if the consumption rate falls below that, it is a dangerous deviation and calls for maintenance investigation. As I said before, this particular engine was using less and less oil. We pulled it, and, sure enough, we found the oil jets in No. 4 bearing peened over. The support brackets were broken loose and that allowed the oil nozzle to rub on the No. 4 bearing, which, in turn, plugged off the orifice of the nozzle. That means less oil was being exposed to one of the factors that affects oil consumption.

No Guesswork

"We weren't completely shooting in the dark when we pulled this engine. We had two indications of trouble in the oil system. The pilot had been checking the oil pressure too, as you know, and we had noted a rise of 5 psi. That told us something had possibly plugged a portion of the oil system.

"You can see there in your Maintenance REVIEW that we hunt for a lot of things when the graphs show decreasing oil consumption. For instance, there is internal leakage of the oil-fuel heat exchanger. On jet aircraft, the JP-4 fuel pressure is considerably higher than the oil pressure within the heat exchanger. Therefore, if you do have an internal leak, the JP-4 will slowly flow into the oil system and—believe it or not—service the oil system to a small degree, depending upon the amount of leakage, resulting in contaminated oil. Unless this leakage is enough to run the oil tank over on the ground, and call attention to this fact, the crew chief isn't likely to remember that this engine hasn't used much oil in the past 10 to 20 hours, or to wonder why.

"With a graphic, progressive history of its oil usage in front of Major Brown, however, he can recognize the trend; we can investigate and correct the leakage. You do know what contaminated oil can do to an engine, don't you, Lieutenant?

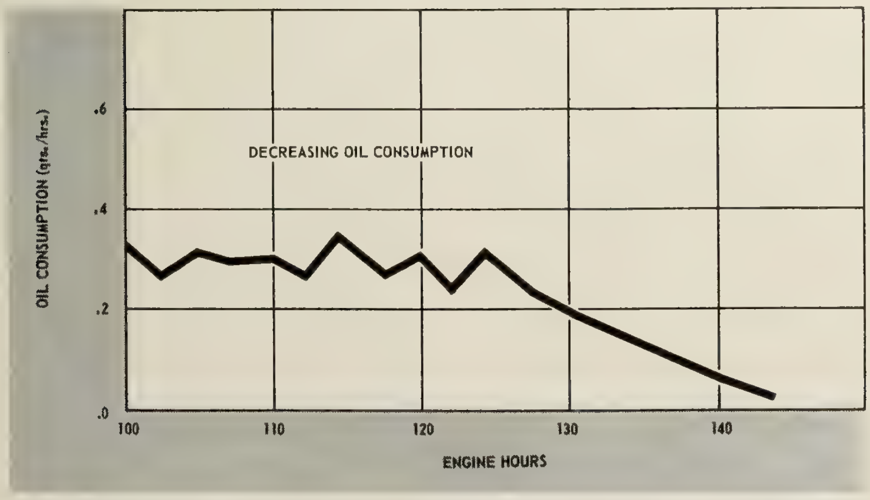
"I hardly need to add that we're also interested in spotting rising oil consumption. Here is another chart. We removed the engine the other day because this chart showed increasing oil consumption. We found excessive wear of No. 4 bearing air oil seal beyond T. O. limits. We removed the No. 4 bearing, No. 4 air oil seal, and returned the engine to service. A little thing? Sure, but if somebody hadn't been watching the consumption records on this baby, and we had not applied preventive maintenance, it would have been another statistic. The engine would have run out of oil and the aircraft would've run out of engine! Over and out.

"Now then, as to that 'eyelid' check your wife was kidding about last night, data on it are technically charted as 'exhaust nozzle lip separation,' and we usually call it the 'nozzle check.' It is basically checking the engine power output like we do when we check the torque delivered by a reciprocating engine. A wider nozzle area means simply that the engine is not putting out properly. It should not be less than 19.5″ or more than 20.5″. Those are limits.

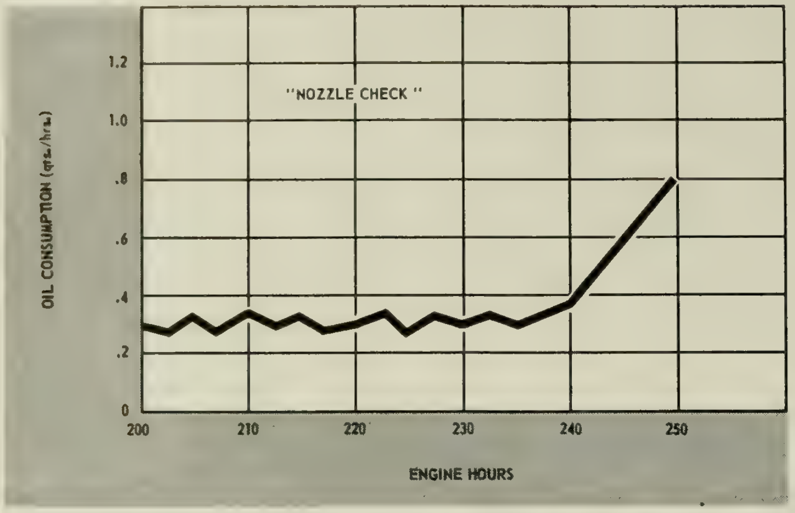
"Here's a chart on one engine which I pulled because every measurement was just a little wider than the one before. We found a bad fuel nozzle, too bad to make one more flight. You wouldn't volunteer to fly the plane with that on it, would you? Well, this brings your original inquiry right home to you because the only way that anyone would have known to look for the cause of the trouble would be to analyze this chart that showed increasing opening of the nozzle — strictly from the figures turned in by a pilot."

"Wouldn't I notice it in the cockpit if there was less than 100 per cent military power?", Lieutenant Smith asked.

"No, and if you'll think back on your MTD, you'll remember why.

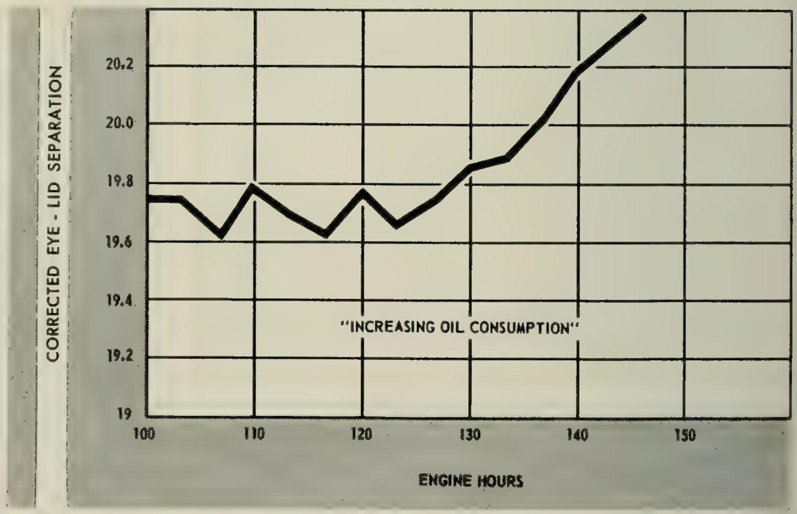


Without lubrication, something's gonna drag.



High consumption rates and fuel flow is real trouble.

It is basically checking engine power output.



"Your exhaust gas temperature indicator is stabilized at 685°C., so, in your opinion the engine is fine. That's a characteristic of the system, remember? The Integrated Electronic Control positions the nozzle to a point to maintain this EGT at 685°C. So you are sitting up there like a duck in a shooting gallery—a potentially fatal accident going somewhere to happen.

"The one thing that prevented it in this case was that we had meticulously kept records. We had a chart showing increasing width in the nozzle opening and we know that this is the signal to remove the engine and find the offending component. This exemplifies the type of accident prevention program necessary nowadays in the Air Force. Although there are still many unknown factors, we do know that nothing can be gained by postponing removal of an engine when the trends indicate trouble. Further, we know that the engine, the aircraft, and the pilot can be lost merely by waiting for something unusual to rear its head. We are losing too many and we don't have that kind of margin.

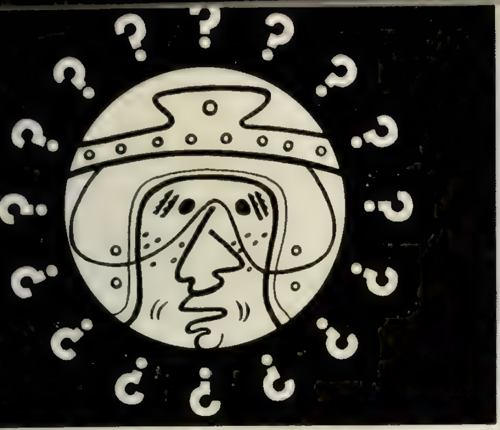
"Here's another thing. Would you care to fly a plane with an engine—standard sea level conditions—that had a nozzle opening of 21" and 4880 pounds of fuel flow per hour? Again, you don't honestly know, do you? You see, your engine is approximately a 5500-pound thrust engine and should require at sea level, approximately 5900 pounds of fuel flow per hour. Oh, there are allowances for outside air temperature, OAT, as we call it. When it is colder, the fuel flow increases a little and when it is hot, it decreases. But if I may press home a point, the underlying purpose of this analysis program is to make everyone aware when a particular part is on the downgrade and possibly dangerous, we can tell, just by reading a chart."

"I was just wondering, sir, since the T-Bird doesn't have a variable exhaust nozzle to check, if you couldn't use EGT to read the power output?"

"You're receiving real clear, Lieutenant Smith. You change that one parameter on the graph for a T-Bird, but coast-down, oil pressure and consumption work the same way."

"EGT, nozzle position, fuel flow, RPM, OAT, pressure—all seem to be such little and even insignificant things to mean so much.

"As the man said, Smitty, life is made up of a myriad of small matters, and life—in this case, yours—is no small matter. You make these small performance checks for us, and, in return, we'll give you maximum possible engine integrity . . . and your continued flying safety. ▲



How Well Can You Remember?

July (Power Plant)

1. In the event of a compressor stall, the *first* thing a pilot should do is to:
   - *(a) Reduce airspeed to reduce vibration.*
   - *(b) Retard the throttle.*
   - *(c) Go to emergency fuel system.*
2. With reference to compressor stalls, as the outside air temperature decreases, the stall margin decreases.
   - *(a) True.*
   - *(b) False.*
3. At a given airspeed, a heavier loaded airplane flies:
   - *(a) At a greater angle of attack than a lighter airplane.*
   - *(b) At the same angle of attack as a lighter aircraft.*
   - *(c) At a lesser angle of attack as a lighter airplane.*
4. At a constant throttle setting, thrust in a jet aircraft remains relatively constant at all normal flight speeds.
   - *(a) True.*
   - *(b) False.*
5. In the event of a fuel leak inflight in the area of the carburetor, and the engine continues to operate normally with little or no drop in fuel pressure, the pilot should:
   - *(a) Shut down the engine using the normal feathering procedure.*
   - *(b) Actuate the firewall shut-off valve.*
   - *(c) Leave the throttle alone and cut the fuel off with the mixture control.*

August (Personal Equipment)

6. Free fall time from 50,000 feet to 15,000 or in that neighborhood, the automatic parachute opening is:
   - *(a) Just over two minutes.*
   - *(b) Four minutes.*
   - *(c) Six minutes.*
7. Parachute opening shock at 40,000 feet, averages:
   - *(a) 9G.*
   - *(b) 14G.*
   - *(c) 33G.*
8. The CO_2 cylinders in your Mae West should be weight checked:
   - *(a) Every 60 days.*
   - *(b) Every 30 days.*
   - *(c) Every 90 days.*
9. The fixed altitude for automatic parachute aneroid controlled operation is:
   - *(a) 12,000 feet.*
   - *(b) 14,000 feet.*
   - *(c) 15,000 feet.*
10. In the United States, all terrain above 14,000 feet is in the form of peaks. The total area of all the peaks at or above 14,000 feet is:
    - *(a) 20 sq. miles.*
    - *(b) 40 sq. miles.*
    - *(c) 100 sq. miles.*

September (Maintenance Today)

11. On some jet engines, a higher than normal oil pressure reading may indicate that:
    - *(a) The crew chief over-serviced the reservoir.*
    - *(b) The engine is operating at too high an RPM for the particular throttle setting.*
    - *(c) Lube lines or nozzles are plugged.*
12. The length of time it takes a jet engine to coast down from idle RPM to a complete stop is a measurement of friction.
    - *(a) True.*
    - *(b) False.*
13. If the fuel flow is abnormally low (350-400 lbs.) on an engine requiring 500-600 lbs., it may light satisfactorily on the ground. However, at altitude:
    - *(a) The fuel flow may be too low to accomplish an airstart.*
    - *(b) It will be impossible to get 100 per cent rpm.*
    - *(c) The engine will flame out.*
14. To cool overheated brakes, maintenance crews should:
    - *(a) Discharge a 20-lb. CO_2 cylinder on them.*
    - *(b) Use a compressed airblast on the wheels and brakes.*
    - *(c) Squirt a steady stream of water on the brakes.*
15. Engine trend analysis is a process whereby:
    - *(a) AMAs determine what happened to an engine after an aircraft accident.*
    - *(b) The pilot uses an engine analyzer to determine if all cylinders are firing and the desired torque is available.*
    - *(c) Engine performance and other data are plotted and analyzed for abrupt changes in performance.*

ANSWERS

1. (b)
2. (a)
3. (a)
4. (a)
5. (c)
6. (a)
7. (c)
8. (b)
9. (b)
10. (a)
11. (c)
12. (a)
13. (a)
14. (b)
15. (c)

OPERATE

DURING MY years of flying experience which includes nine years in the Air Force and more than five of experimental test flying with the General Electric Company, I have had the opportunity to see first hand the development of many new aircraft systems. With this experience and background, the words of wisdom which seem most important to me are: "Know your aircraft and equipment before you step into the cockpit for the first flight."

There was a time when, if you referred to a fighter pilot as a good stick-and-rudder man, you paid him a great compliment. Many pilots enjoyed this compliment and developed a self-confidence which prompted them to fly many airplanes with a minimum of knowledge of each. They relied primarily upon "stick-and-rudder-experience" . . . betting against the odds that nothing would happen that they couldn't handle by jockeying the throttle to enable them to fly the aircraft safely back for a landing.

It flies just like any other airplane—almost.

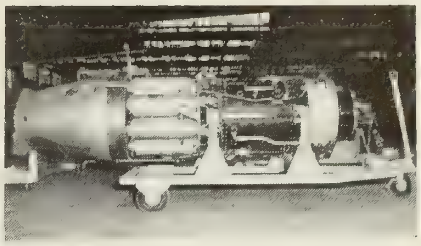
When you step into the cockpit of a Century Series aircraft (no matter which one it happens to be), you'll be in for a completely new flying experience. You will no doubt be surprised during this first experience with how familiar you feel in the cockpit and the ease with which the aircraft handles. You'll probably say to yourself, as you step out of this aircraft with "no" wings and a radical design: "What's all this 'hubba-hubba' about flying a Century Series type? It flies just like any other airplane."

True, you have had a successful flight and no doubt a few new wonderful experiences and the odds are that you will have many more such flights in the aircraft. But, have you really flown it? Would you make the right decision if you had an abnormal indication in the cockpit? Were you looking at the right instrument to tell you that everything was normal when you lit the afterburner?

Those instruments in the cockpit can give you a complete story only if you know what they are trying to tell you.

When I am scheduled for a checkout in a new aircraft, regardless of whether it is the first flight in a new configuration or a routine checkout in an operational aircraft, I first make a complete study of the Pilot's Handbook. Next, I gather from other pilots and engineers as much information as possible on the aircraft and engine characteristics in flight. From this background information I establish for myself a complete set of cards outlining operational procedures and characteristics of the particular air-

Old dogs sometimes have to learn new tricks. As the sciences of warfare and aircraft change, you must be prepared to change right along with them. Despite what went before, you must now. . . .



Roy E. Pryor, Chief Test Pilot, General Electric Company

to MAINTAIN

craft and engine. With these procedures in mind it is easy to monitor all instruments in an orderly sequence in any situation.

For example, let's look at engine operating procedures from the starting sequence to shut-down to see what the instruments are trying to tell you and how you can use this information to best advantage. We are speaking of jet engines in general and no specific model.

Engine Operation

First, you can tell a great deal about the condition of an engine by the way it starts. The pilot must monitor closely the engine instruments during the starting sequence, for a maladjusted or malfunctioning fuel control or fuel regulator can cause damage or even ruin a $200,000 engine if the pilot is asleep at the switch.

Occasionally I've seen pilots hit the start switch, then begin to adjust their harness or helmet and mask while the engine is accelerating to idle RPM. The folly of this technique should be apparent to everyone. The pilot should know the starting characteristics of his engine and monitor the instruments in a manner which will tell him that all conditions are normal, or give him advance warning of impending difficulties. The normal sequence of events that he should monitor is: Start switch ON . . . RPM increase. . . . Throttle advance. . . . Fuel flow up to proper value. . . . EGT within limits . . . then oil pressure as you reach idle RPM. If any abnormal indication should occur at any point in the start sequence, the pilot can abort the start and prevent further difficulties.

For instance, say a certain engine requires 500 to 600 pounds fuel flow for a normal start, if the fuel flow is 900 pounds, a hot start will more than likely result.

On the other hand, if the fuel flow is low—say 350 to 400 pounds—it may start satisfactorily on the ground, but at altitude it is extremely likely that the fuel flow will be too low to accomplish an airstart should there be need for one.

Also on starting, if the engine fails to light within the specified time after fuel flow (increase in EGT is a sure sign of light), shut it down! You probably have faulty ignition; also a delayed light can cause overtemperature during the light-off.

Know what they should be reading and you can make a positive check.

Responsibility has to be properly delegated even down to the most junior man on the bird—including pilots.

Each man must feel that he is part of the airplane and his efforts help to keep it flying.

Knowing your airplane and equipment can be the difference between success and failure.

If the engine instruments are not within limits during the starting sequence the pilot should refuse to accept the aircraft for flight until the trouble is corrected. And, by all means, DON'T attempt a second start when something goes wrong with the first start unless you are sure what the trouble was. Have the engine inspected and the malfunction corrected.

Further, if you are fortunate enough to fly the same airplane quite frequently, know what the normal oil pressure for that particular airplane is. On some engines, a high oil pressure indicates plugged lines or lube jets; similarly, a low pressure may indicate an oil leak.

Well, you have started and have taxied to takeoff position. As you hold the brakes and advance the throttle to military power, be sure to make a careful check of engine instruments, the EGT, the nozzle position, RPM, oil pressure, pressure ratio and fuel flow. Know what these instruments should be reading and you can make a positive check on the engine before releasing brakes.

Make it a habit to watch the nozzle position indicator and EGT when going in or out of afterburner. A nozzle which does not open after afterburner light can cause over-temperature of the engine.

Also, on engines with a fully modulating nozzle, if the situation occurs which requires you to come off afterburner shortly after takeoff (say the gear failed to come up), always monitor the nozzle indicator for proper closure as you reduce the throttle.

If the nozzle is not closing do not come off afterburner but use speed brakes or climb to hold the speed down. If you come off afterburner and have a wide open nozzle, you can not maintain flight speed with the gear down. The possibilities of getting an afterburner relight under these conditions are limited.

Emergencies

I hesitate to go into inflight emergencies, for they vary so greatly with different airplanes. I can not place too much emphasis, however, on the importance of knowing the contents of those red bordered pages in your Dash One Handbook. You should not only know WHAT to do, but also WHY you are doing it.

Let's assume you have the airplane back on the ground and are ready to shut it down. This phase is important too, even if the flight is over.

Shut Down

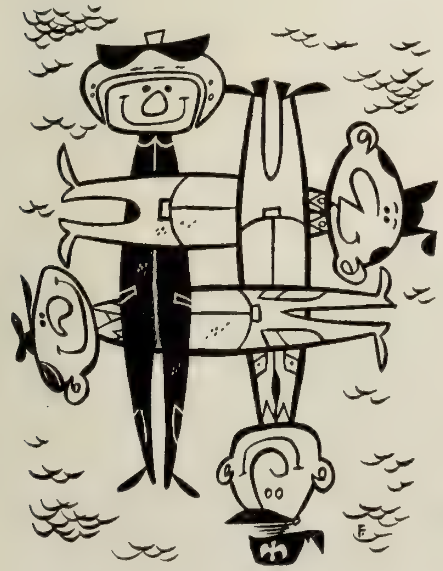
Here at General Electric, we shut down from the minimum EGT (usu-

ally a point slightly above idle). Again, before chopping the throttle, check the oil pressure. When the EGT has stabilized, chop the throttle and check the engine coast down time. Be ACCURATE on this time to the nearest second, then log it in the Form 781.

While the engine is coasting down, we have one or more individuals stationed around the aircraft to check for any unusual noises and to check for engine roll-back. Lack of engine roll-back and reduced coast down time are indications of possible engine difficulties.

These individuals also check for fuel drainage when the throttle is stop-cocked. If it doesn't drain, we are prepared to plug in an APU and motor the engine to prevent a fire in event the drain valve is malfunctioning or the drain is plugged.

Today's operations require a close-knit team.



I feel that there are many things that pilots can do to ease the maintenance load. Too many pilots often do not have enough regard for the equipment. It's one thing to get maximum performance out of an aircraft but you shouldn't abuse the aircraft and engine while doing it.

The pilot must also have an honest desire to keep the airplane in the best of condition. During accelerated service tests on an F-86H our pilots flew one aircraft and one engine over 500 hours in 16 weeks. During that time we attained an average of 62 landings on a set of tires and had practically no brake troubles, simply because the pilots handled the aircraft with care.

They wrote up discrepancies which were actually corrected as they occurred, rather than waiting until a large number of small items ganged up on the maintenance section.

One word on the relationship of the pilot-to-maintenance crew. Today's type of operations and equipment requires a close-knit team. Pilots and maintenance crews must work together and tell each other all they know about the peculiarities and characteristics of the individual airplane.

Responsibility should be properly delegated, even down to the most junior man working on the airplane. Don't look to the maintenance boys as scapegoats when things go haywire. Make each man feel that he is part of the airplane and his efforts are needed to keep it flying.

Knowing your airplane and equipment will mean the difference between success and failure of many missions, whether it be that final effort to get on the target or to make the right decision that will get you and your aircraft safely home when something doesn't work—as it always has before.

Space and time hardly permit me to relate the many experiences during my flying career that have contributed to additional gray hairs. Some have prompted me to take out additional insurance but otherwise have been completely successful I could not honestly say that the success of any one of them was the direct result of superior pilot technique.

Instead, in every case the success has been the direct result of knowing and understanding of the aircraft characteristics and its systems. I feel confident that any pilot with the same knowledge and understanding of the aircraft systems could have made the right decisions under the same adverse situations. ▲

About the Author

Roy E. Pryor is an Air Force veteran who spent six of his nine years on active duty with the 8th Fighter Group. He participated in the first F-86 flight across the Atlantic in 1951.

Since 1952 he has been at Edwards Air Force Base, as Chief Test Pilot and Supervisor of Flight Test Operation for the General Electric Company.

• • •

IP....FOR

DO YOU HAVE a pet peeve about that tin eagle that you fleigle for Uncle Samuel and all of his nice kinfolks?

Most pilots do and, with little encouragement, they will sound off about it in sulphuric terms that could frizzle a first sergeant's hair. A Jock can steam up a high psi rating when he stews and sizzles over the perverse traits of his spavined Pegasus.

Steam is valuable and it shouldn't be wasted, engineers say. If a process produces steam as a by-product, the engineers are quick to convert this extra energy into productive work. If nothing else can be done, they'll use it to tootle the factory whistle.

So, why not harness this pilot steam, and use it to "blow the whistle" on aircraft design features that displease you? It is a positive fact, easily proved by statistics, that pilots know more about what pilots don't like than any other people, including the Scandinavian.

Berating the recalcitrant bird on the flight line, in the Officers Club or in the kitchen, is not likely to produce any significant modification of the aircraft. Pilots arise. Be not as the wild jackass that brays (though unheard) in the desert wilderness. Use your USAF-given right of the UR.

No one individual ever designs a complete airplane all by himself anymore. It happens as a result of a long chain of experiences to which all of us make contributions from time to time. Most of us just fly 'em and leave the drawing board to someone else. But that doesn't mean that you can't get into the act. The kind of designing you can really get your teeth into is the kind you think of every time you are tempted to say, "Who the devil ever let 'em build it this way to begin with?"

There was a bull session just the other day. Everybody was swapping hairy tales, as pilots will. This day, about airplanes. One chap came up with a spine tingler all about the time he parked his T-Bird on the ramp after shooting a "bunch of transition." As the crew chief was replacing the pins, he suddenly discovered that he didn't have the canopy pin—only the streamer and attaching ring. The pin was still right there in place, where it had ripped out of the ring.

"Boy," says one old troop, "That's a PIP if I ever heard one."

It was a weak pun, to be sure. He finally put it across by butting in with: "How many of you guys submitted a UR as result of your near-devastation?"

Silence. And here was a bunch of good heads who had a real interest in developing good airplanes and keeping them that way. Any one of them would have offered you a ride home and driven three miles out of his way just to be nice to you. Thoughtful, sure. But did they do anything to save your neck? Or their own?

The steam was there but it just wasn't going the right way.

One said, "Well, it would have taken 45 minutes for the mechanics to find the trouble so I came on in."

Another allowed that he figured the crew chief would take care of it.

Still another didn't know just what the procedure was, and anyway you don't have to submit URs on all that sort of stuff, and how did you ever know?

From the sound of the conversation not only the problems needed a UR. So did the excuses!

But where does the pilot fit into the Product Improvement Program (PIP)? If you're like everyone else who has looked at an accident you'll agree right off that it is an accumulation of events—a chain-of—somebody said. And if you make it a chain,

Aircraft design happens as a result of a long chain of experience to which all of us make contributions

PILOTS

which link do you want to depend on? The one that you know is weak and you haven't done anything to correct? Certainly not. Well, none of these guys did, either, but that's what they demanded—just from the fact that they knew about it but did nothing. Even as you and I.

What should have happened?

It is pretty hard on most bases to walk from an airplane to operations without passing within spitting distance of a maintenance shack of some sort. And the odds are pretty good that in every one of those shacks there is a pad of blank URs. Fill one out—in pencil—and you've contributed to the PIP program. That's all you have to do.

Contrary to popular belief, you do not have to research anything. You don't have to analyze any problem. You don't have to explain anything; just tell what happened to you. And what may happen again—only worse.

You couldn't care less about how many times this sort of thing has happened before or how many times it may have been reported. You're not even remotely bothered about whether the maintenance officer got an answer to the same type of trouble before. That's his problem. Your job is to let him know that something is wrong, right now.

Okay. You say he can read and why can't he read the Form 781 and fill out his own papers? Sure. He can and does. But *whose* papers, did you say? *Who's* flying this bird, you or the maintenance officer? These little billet-doux are just like premiums on an insurance policy (the one covering you).

The Maintenance troops will get into the act, too, but from their own end of the business. If something breaks ahead of schedule or doesn't fit their program, the way it should, they'll UR it—rest assured!

But—going back to where we started—nobody knows more about what pilots don't like, than the pilots themselves. And this includes you.

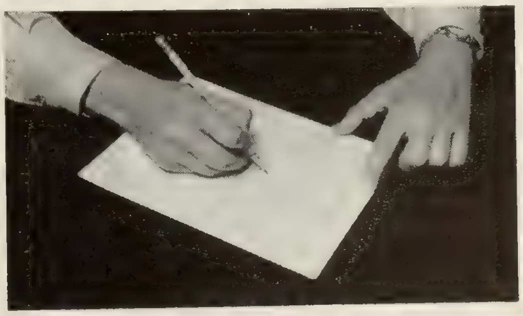
The man on the line may get too busy trying to glue it back together to take care of paper work you suggest might be a good idea, from your point of view. But even if he does have the time, he's not in the position you're in. You're the one who knows what happened, when it happened and what you had done or were doing when the whole thing came about. This makes you the star witness in the case and probably the only one who can tell the whole story.

This is often a big factor in the old discussion about no action being taken on URs submitted. The long and short of many URs that got little or no action is that there just wasn't enough information on which to base firm action. The files contain many reports that were obviously made up by persons who had too little factual data at their command to write a good report. Detailed information may assist in solving the problem for everyone concerned.

Designers, too, are human. To expect them to build a perfect bird is left-field thinking. But that doesn't mean the bird can't be improved upon and that is where you come in. The designer may never have had a chance to fly the thing, but you have. And there you have a big advantage on him.

The day you come across a perfect airplane—that's the time you'll turn in your insignia. And Old Saint Pete will be standing right next to you, ready to take it. Between now and then, don't be satisfied with blowing off steam in all directions. Put it in the pipe provided. Pipe? No—PIP—your Product Improvement Program. ▲

ating a bird on the flight line accomplishes nothing. The answer is: Use your right of the UR.



SPLASH DEPARTMENT . . . accidents resu

AN F-84F, SCHEDULED for an IFR round-robin navigation flight, departed its home station with full internal fuel, plus two 230-gallon outboard and one 450-gallon inboard fuel tanks. The first leg of the flight was to be flown at an assigned altitude of 15,000 feet.

After reaching altitude, the pilot checked the fuel tanks and determined that only the 230-gallon tanks were feeding. About 25 minutes later, the fuel pressure warning light began to flicker. A further check revealed that none of the external fuel tanks were feeding and that the liquidometer was malfunctioning.

The pilot advised air traffic control that he was returning to his point of departure. He began climbing to 35,000 feet, hoping to reach his home base on the remaining internal fuel. He was close when the '84 flamed out. The pilot set up a flameout landing pattern and dropped the external fuel tanks. He was unable to see the runway part of the time while in the flameout pattern because of a 2700-foot broken deck of clouds. When he penetrated the deck, he found himself in such a position that he was unable to kill off enough airspeed to avoid landing long.

The "F" touched down approximately 2000 feet from the barrier at 145 kts. The speed was estimated to be 135 kts when the barrier was engaged. The engagement was successful, however, the aircraft was damaged considerably.

Investigation revealed that the ground refuel switch for the external fuel tanks was not closed after the refueling operation. The pilot did not notice this on his walk-around preflight inspection. The pilot failed to determine the exact amount of usable fuel that he had in time to divert to an available base nearer than his home station.

■ ■ ■

IMMEDIATELY AFTER TAKEOFF, the pilot of an F-86A noticed that the aft fire warning light was on. He throttled back, checked for smoke and simultaneously declared an emergency. The aft light went out as he throttled back and, seeing no smoke, he elected to land. The landing was made without difficulty; however, as the pilot applied power, black smoke came from the tailpipe. The engine was stopcocked but there was fire in the aft section.

Investigation disclosed that the fire was caused by failure of the combustion chamber fire cross-over tube between chambers 6 and 7. The insert on No. 7 combustion chamber was not properly aligned with the cross-over tube. The forward fixed fuel drain lines between chambers 6 and 7 (located directly behind the blown cross-over tube) had been subjected to intense heat, causing the connections to melt and allowing the drain lines to separate from their fittings.

Examination of the aircraft's air intake nose duct revealed that a wooden dust cover was in the duct during flight and had lodged against the bottom of the engine intake screen.

The Form 781, Part II, indicated that a preflight had been made and the '86 had flown one previous mission on the day of the accident. The pilot who flew the previous mission had okayed the flight even though he had noticed a definite rumble sound in the engine, had experienced a hanging start (the EGT went to 690 degrees but the engine would not accelerate beyond 24 per cent on the first attempt at starting). After the second start, he had to use more runway than was normal for takeoff. The crew chief and both pilots had looked into the nose duct but did not see the dust cover.

■ ■ ■

TWO PILOTS ON AN INSTRUMENT training flight in a T-33 were cleared for a penetration and GCA. On the final approach the T-Bird was told to pull out of the pattern because of other traffic. As the pilot applied power and raised the speed brakes, he heard a rumble and the engine flamed out. The Instructor Pilot in the front cockpit took the controls and tried an airstart, but without success. He then bellied the '33 into a snow-covered field.

The Accident Investigating Board determined that the flameout was caused by ice in the low pressure fuel filter. It was further determined that the crew chief had failed to drain the tiptanks during preflight (Arctic operation) and that the pilot was not thoroughly familiar with the de-icing procedures as outlined in the Dash One.

■ ■ ■

A C-47, ON A FLIGHT TO resupply outlying radar sites, prepared to take off for the final leg to its home base. On runup, the oil pressure on the right engine dropped to zero. The engine was shut down and the crew chief checked the oil tank and found that it was full. He also checked the engine for oil leaks and could find none. On the second start and runup, oil pressure registered 15 psi. The aircraft commander decided to take off anyhow (despite the objections from the crew chief) inasmuch as a small emergency strip was only 22 miles away.

Approximately two minutes after takeoff, the oil pressure on the right engine dropped to zero. The aircraft commander instructed the copilot to feather the engine. The prop refused to feather. Power settings on the left engine were increased to 45" Hg and 2350 rpm. The C-47 would not gain altitude because of the load and the windmilling prop. The cylinder head temperature on the left engine went to 400°C. and the aircraft commander steered the Gooney toward the emergency strip at an altitude of 150-200 feet. The surrounding mountainous terrain made it impossible to return to the departure point. When it became obvious that a crash landing was imminent, the crew chief was instructed to go to the rear and strap himself into a rear seat. The C-47 crashed in a heavily wooded area approximately half a mile short of the emergency strip. The aircraft commander, co-pilot and navigator were fatally injured. A third pilot occupying the radio operator's compartment received minor

g from faulty maintenance or inspection

injuries. Personnel in the passenger's compartment escaped uninjured.

The Investigating Board determined that the aircraft commander erred in taking off with an apparent malfunction without determining the cause.

■ ■ ■

SHORTLY AFTER TAKEOFF and while climbing in afterburner, the pilot of an F-89H heard an explosion. He throttled back and checked his instruments but everything was in the green. Assuming that he had lost an engine door, he asked his wingman to check the Scorpion. He was advised that the left battery door was missing and that the left forward air intake duct was damaged.

The pilot returned to his base and after dumping his tips and burning up part of his internal fuel, made a normal landing.

It was determined that while the '89 was being preflighted, word had been received to tow it to the alert hangar. The two airmen who were preflighting the aircraft had partially buttoned up the battery door and notified the towing crew that the engine screen bottles needed servicing.

The pilot and radar observer arrived at the airplane some 30 minutes prior to takeoff time and began an external inspection, not knowing that the preflight had not been accomplished by the ground crew. When the pilot noticed that the preflight had not been signed off, he sent the Form 781 into the Maintenance shack and an Airman signed it, assuming it had been performed but not entered.

The pilot did not notice the loose Dzus fasteners on the battery door when he accepted the aircraft for flight.

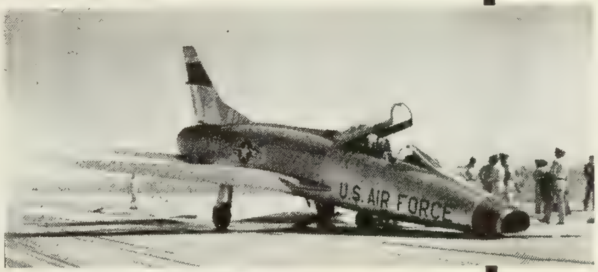
The Accident Investigating Board decided that the pilot had failed to accomplish an adequate preflight inspection and that the maintenance crew had erred in signing off a preflight without knowledge that it had actually been performed.

■ ■ ■

IMMEDIATELY AFTER TAKEOFF the pilot of an F-100C called his element leader saying that he had an unsafe gear indication. The flight leader checked his wingman's aircraft and noticed that the nose gear door was open about two or three inches. As soon as the fuel load permitted, the wingman entered traffic for landing. He touched down at 155-160 knots IAS, approximately 1000 feet down the runway. When the nose gear was lowered, a violent shimmy occurred. The pilot applied back pressure immediately and held the nosewheel off for another 800 feet. When the nose gear contacted the runway it shimmied again, and violently. At 5500 feet down the runway, the nose gear strut collapsed.

Investigation revealed that the nose gear scissors bolt was inserted but not locked and that during taxi and takeoff, normal vibration caused the bolt to work loose and fall out. This allowed the scissors to open on takeoff and the open scissors prevented the nose gear door from closing.

CARELESSNESS . . .



CAN BE . . .

COSTLY ! !

The Accident Investigating Board determined the primary cause of this accident to be a maintenance error, since the crew chief had failed to install the scissor link locking pin, correctly. A contributing cause was the pilot's mistake of not checking the scissor's locking pin during his walk-around inspection.

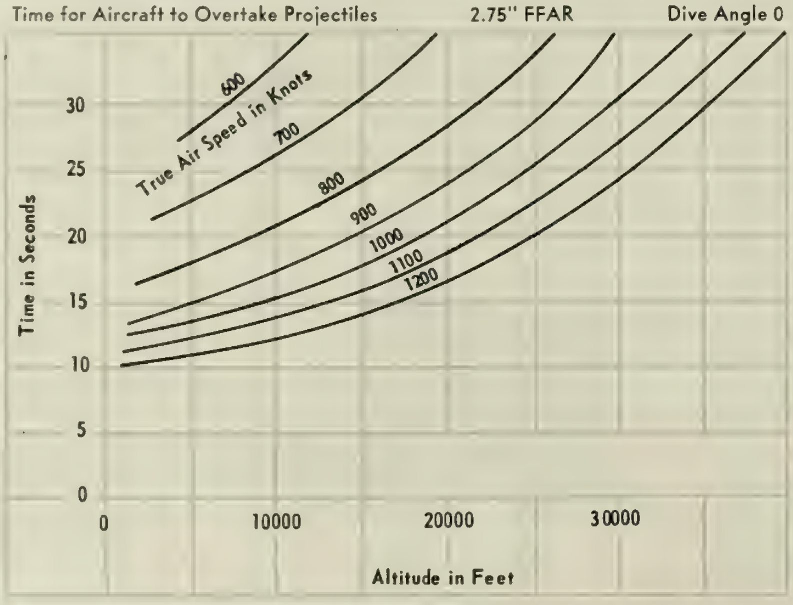
■ ■ ■

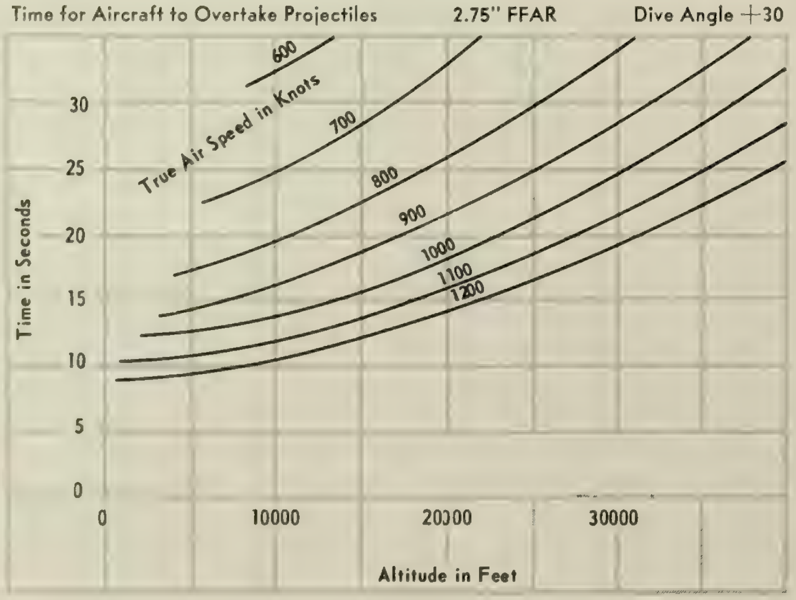
AN F-80C PILOT noticed smoke in the cockpit right after takeoff from a base other than his home station. He was not sure which surrounding areas were heavily populated and was reluctant to drop his tiptanks before landing. His first approach to the 6800-foot runway was too hot so he took it around. On his next approach, he touched down fast, about 1000 feet down the runway. The pilot was unable to stop the '80 and the nose gear collapsed as it rolled off the overrun into soft soil.

The smoke was caused by a loose oil cap which allowed oil to run over in the plenum chamber. The Alert crewman had installed the oil cap improperly and the pilot neglected to check it on his preflight inspection.

Despite what you thought when you first heard it, it is possible to. . .

...Shoot Yourself





REMEMBER THE STORY about the Navy fighter that shot itself down? According to the newspaper stories that came out a few months ago, the pilot fired a projectile, then overtook and collided with it. There were a lot of the old hands who laughed and made jokes about the pilot who "shot himself down." There were a lot more who said flatly that it just couldn't happen. At least one of them asked how many times one had to do that before he became an "Ace." To wind it all up, it was generally conceded that even if it had happened once, it wouldn't happen again in a million times.

At any rate the whole affair sparked a lot of interest. Fortunately, for a lot of us, it piqued the curiosity of some people in the Air Munitions Development Laboratory, ARDC. They took the matter seriously and decided to have a real close look at the problem. Was it really a problem that we needed to do something about? Or was it, in fact, just a happenstance that might never happen again?

Surprising as it may be to some of us, they found that you can very easily shoot yourself down! Granted, you have to use the right technique. But it is, nonetheless, possible.

Here is how you, too, can do it. Using any one of several projectiles referred to in what follows, fire away! Immediately after you pull the trigger, increase your dive angle, pick up some speed and hold the same course. If your vertical drop matches that of the projectile, you'll hit your-

Down!

self. This is just one way to do it. There are a number of others as you will see by reading further.

All of this works almost exactly on the principle that you learned in basic Physics. Remember the "Monkey and Hunter Experiment?" A hunter aims his gun and fires directly at a monkey in a tree. At the instant the bullet leaves the barrel of the gun, the monkey drops. The two should collide in mid-air, regardless of the speed of the bullet. Why? Because the force of gravity is working equally upon the two.

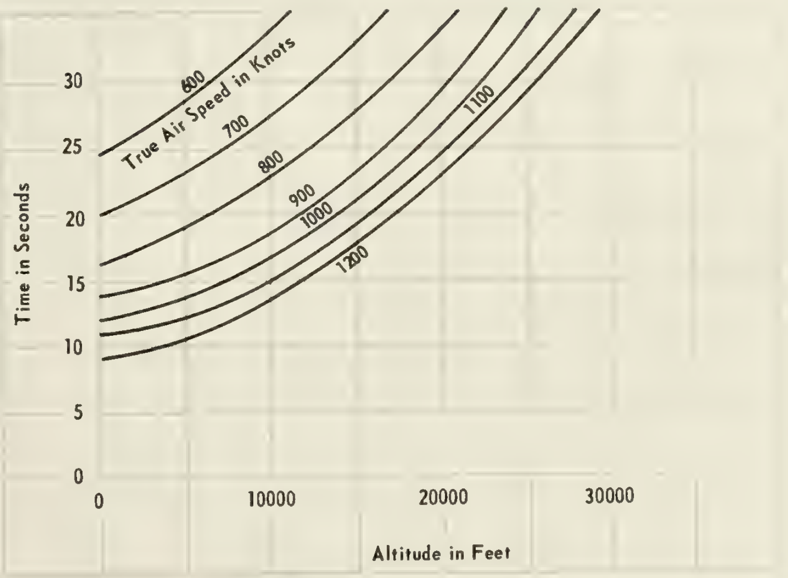
There is one more factor that you have to add in when you talk about high speed projectiles such as those you use. That is air friction. The faster you go, the more graphic this drag appears. And it is, of course, greater in the lower altitudes (and hence, denser atmosphere).

Air friction acting on the projectile results in deceleration—which, in turn, causes it to drop rapidly after leaving the aircraft.

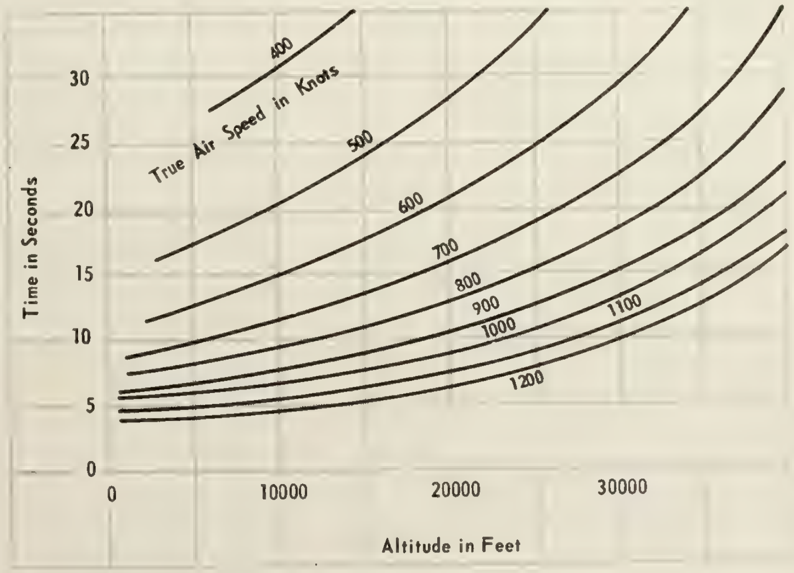
But what about you? Here is where you become the master of your fate. If, through any method, you match the drop of your projectile, you may be in trouble. After doing that, you merely have to be there at the same time. To be at the same place at the same time, is to have your leg shot off.

To match the drop (and be in the same place) merely drop your nose. This means that if you're in a climb when you fire, merely decrease your rate of climb, return to level flight, or put it into a dive. All amounts

Time for Aircraft to Overtake Projectiles 2.75" FFAR Dive Angle —30



Time for Aircraft to Overtake Projectiles 20 mm M-39 Dive Angle 0



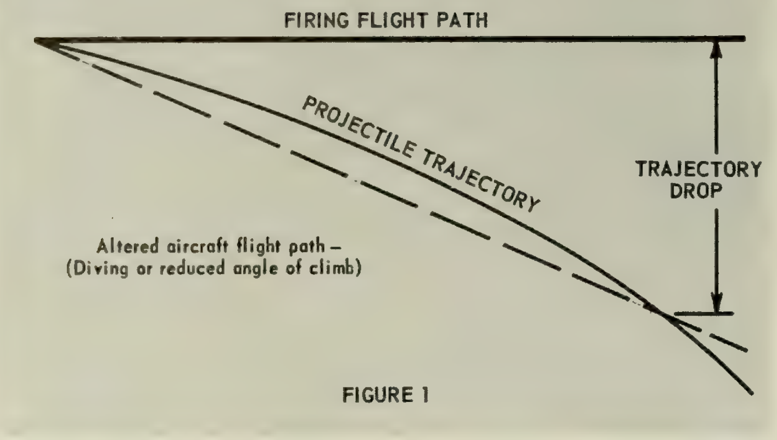
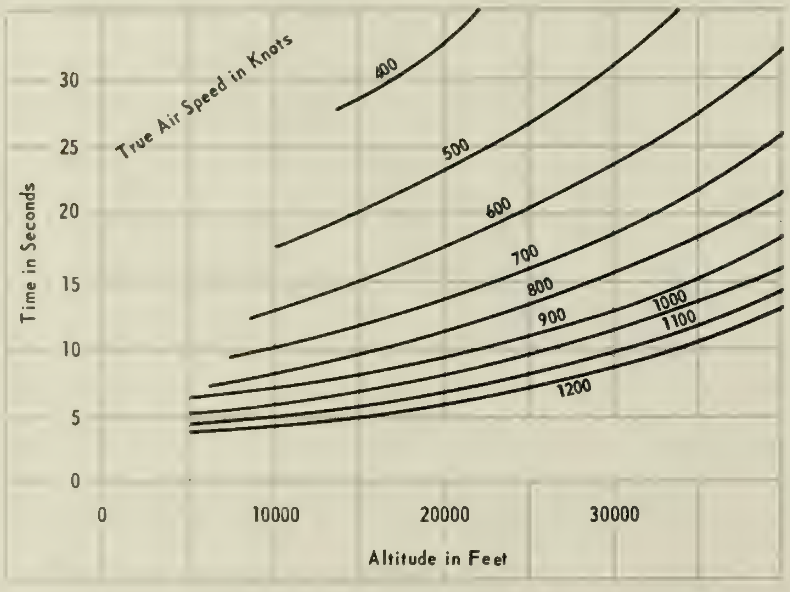
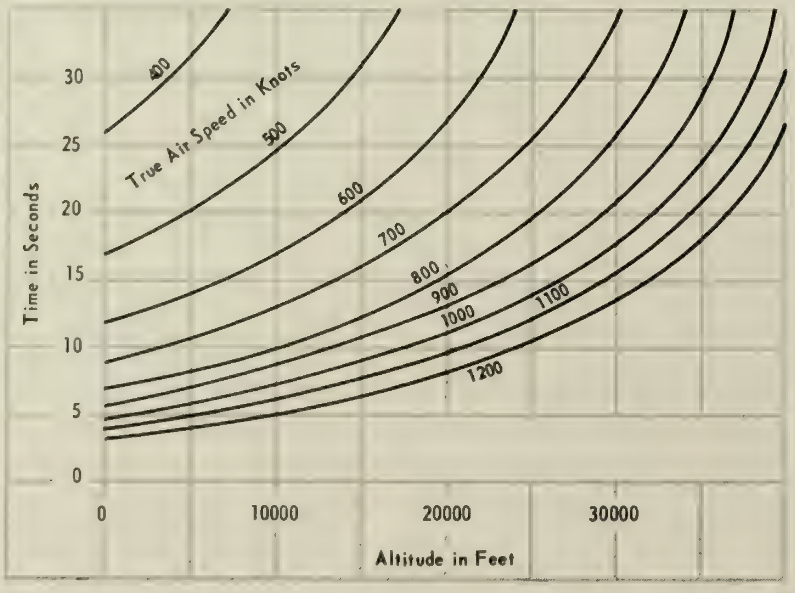

FIRING FLIGHT PATH
PROJECTILE TRAJECTORY
TRAJECTORY DROP
Altered aircraft flight path –
(Diving or reduced angle of climb)

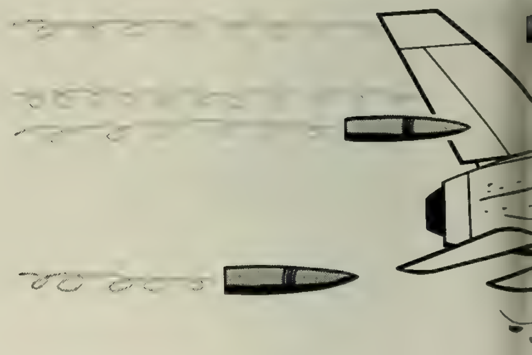
FIGURE 1

Time for Aircraft to Overtake Projectiles 20 mm M-39 Dive Angle +30



Time for Aircraft to Overtake Projectiles 20 mm M-39 Dive Angle —30





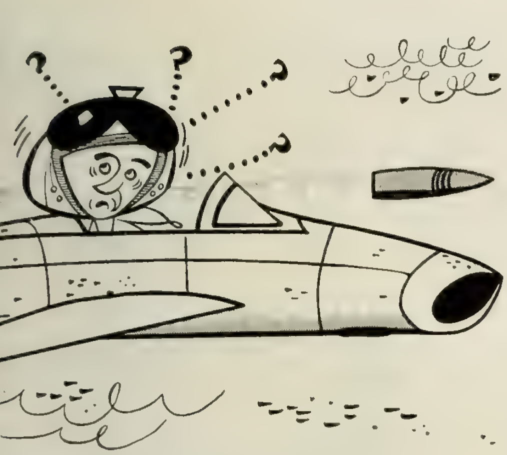
to the same thing. Just match the drop and you're there.

How to Get There

To be there at the same time is just as simple. Again, dropping the nose will gain you airspeed with which to overtake your projectile. Pushing the power stick forward will help out a little. But remember, you won't need a great deal of help because your projectile is decelerating all the time. Just holding what you've got will get you there in some cases. In the words of the experts at the Armament Center: ". . . if the aircraft remains in the same vertical plane after firing and reduces the angle of climb or increases the dive angle and increases speed, or does any combination of these, that will make the vertical drop of the aircraft match that of the projectile, the aircraft can overtake and collide with the projectile as illustrated in Figure 1." A good long look at the figure will clear up some of that.

Okay. So now that you know all this can happen, just what should you do? We've got some real handy rules of thumb for you, but first take a look at the rest of the charts. These too, were furnished by the Air Munitions Development Lab. They illustrate the time required for you to overtake your projectile for various angles of flight, airspeeds and altitudes. As you see also there are different charts for the M-39 and M-61 (T171) guns and the 2.75-inch FFAR. These were calculated on the assumption that the horizontal component of your true airspeed would remain constant after you fire and that your projectile would have a normal, stable flight.

Let's take a f'rinstance. You're on the gunnery range firing air-to-air at 15,000 feet. You're packing 2.75 Rock-



ets. Let's see how much time you have after you pull the trigger before you have to do something to avoid your own artillery. First, let's take a case where you go in level—dive angle, zero degrees. Your true airspeed (TAS) is 700 knots. According to the chart, you have 30 seconds before you will arrive just holding what you've got. Just a half a minute.

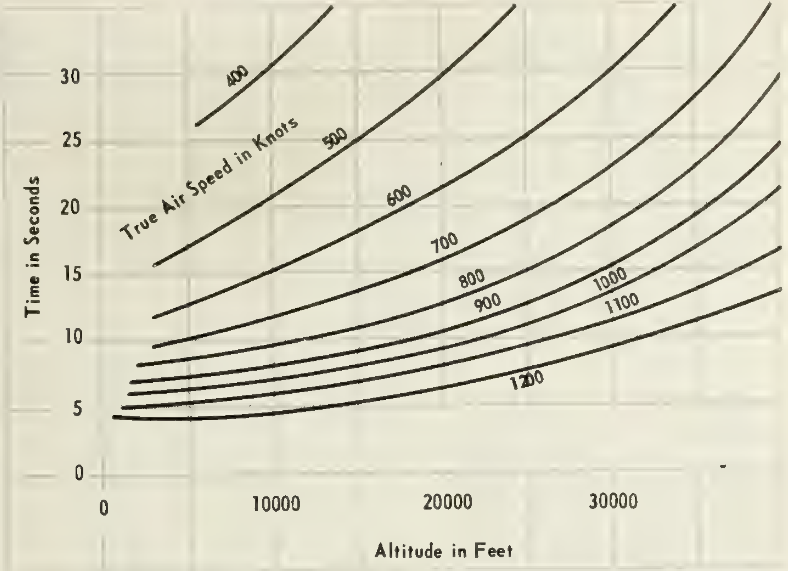
Just for kicks, let's say you missed yourself on that pass and you came around for another. You're a little low on this one but you fire anyway—in a 30-degrees climb but still at the same TAS. This cuts your odds down by a little more than two seconds, for this time you have a little over 28 seconds before you start picking up your own flak.

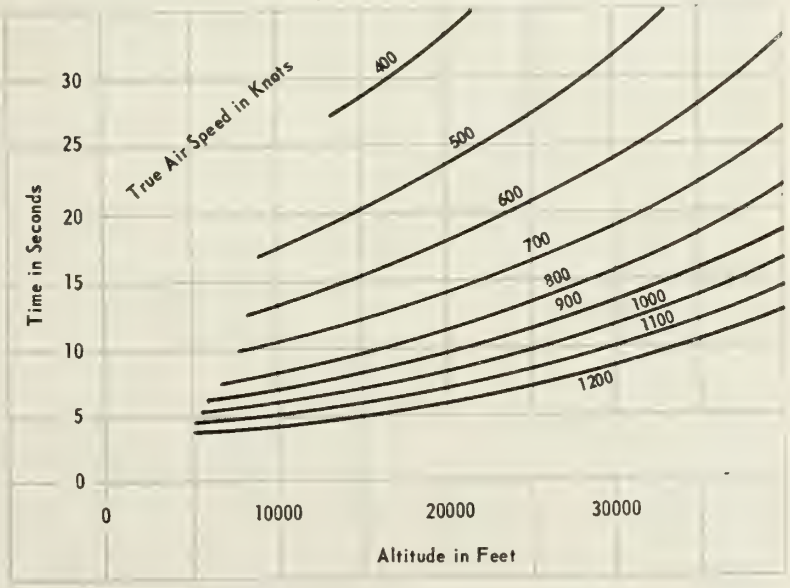
A fast look will tell you that you would have been much better off had you been in a 30-degrees dive on that pass. That way you would have had almost six additional seconds just to play around. At that speed six seconds worth is a little more than a mile.

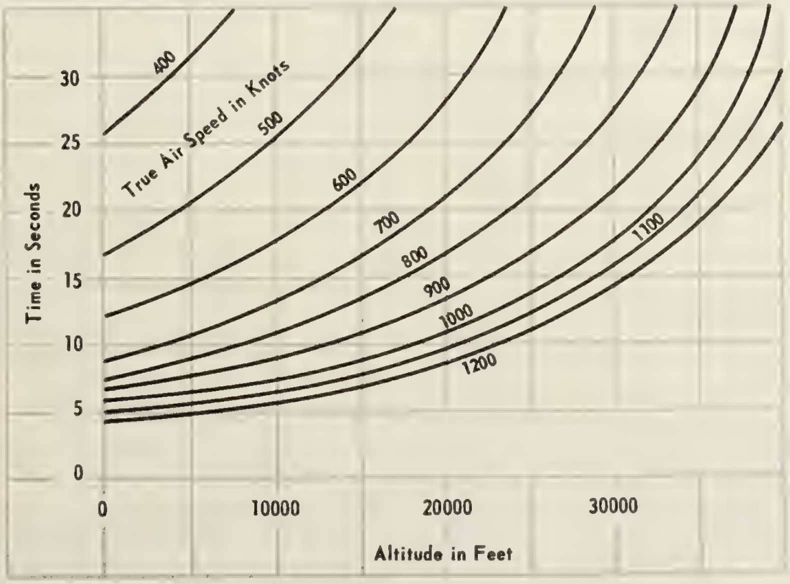
Does that firing pattern begin to make a little more sense? That break after firing means a little more than just getting out of the way of the next guy—part of it is getting out of your own way.

Now here are the rules:

- Whenever possible, alter your course within the time limits on the charts.
- Don't increase your dive angle immediately after firing.
- Be good to your gun barrel. This is the only way you can help insure that your projectile will go where it is predicted to go. Your Armament Officer can help by insuring that the barrel is not used beyond its rated life but only you can make it last that long. ▲


Time for Aircraft to Overtake Projectiles 20 mm M-61 Dive Angle 0


Time for Aircraft to Overtake Projectiles 20 mm M-61 Dive Angle +30


Time for Aircraft to Overtake Projectiles 20 mm M-61 Dive Angle —30

One

THE C-124 was settled into its parking place for the night at a base far from home. Rest and quiet pervaded its vast structure. It had the look of confidence that goes with all well-kept things. "Old 711" had never aborted a mission; it always got its cargo to the South Pole, to the Orient, to Europe or somewhere Stateside. It was a crucial cog in the U. S. Air Force's operations wheel and was proud of it.

Seven-Eleven had noticed another Globemaster parked nearby, but with a caution born of indoctrination in the nature and import of their maneuvers, had refrained from hurried exchange of amenities. After a moment, however, a cordial gleam of recognition lighted its frame.

"Why, if it isn't Six-Thirteen, itself!" 711 called over.

"I saw you come in," 613 replied, "Only plane I ever saw that could strut sitting on its wheels."

"I haven't seen you since we met on that Cross-Road operation," 711 recalled, "Where've you been all this time?"

"Oh, I see the world—with sort of a jaundiced outlook."

"Are you making your trips without any trouble?"

"Oh, I fly, but I stay tired all the time," 613 explained. "More tired than I should be for what I do. I have a lot of aches and pains and don't have much pep. I used to get excited over these jaunts but I'd just as soon stay home, now."

"Wouldn't you know it?" No. 711 thought. "You ask somebody how it is and they'll tell you every time. Oh, well, maybe she will feel better to get it off her chest." And then aloud, "Have you been in to Maintenance lately?"

"You know I have. I have regular checkups. I get the usual attention. If something breaks, they take it off and put on a new one. I'm always getting something new but the first thing you know, it breaks too."

"If I recall," 711 contributed, "you had a pretty sick engine the last time we met. Guess you got it treated."

"Was that the time my No. 2 engine was low on torque and I was laying down such a smoke job that all the planes in that end of the field went on instruments?"

"That's the time."

"Just wait 'til I tell you the rest of that story," 613 was enthusiastic. "My crew was watching No. 2 and expected to feather it before we got home. But they didn't pay any atten-

For The Record

It's the little things . . . But the little things about engines add up very quickly—unless you get in the act.

tion to No. 1, and it was drinking oil like it was going out of style. It was the sleeper that made it an odds-on bet that we'd all drop in the drink and nobody would ever know why.

"We weren't more than 800 miles out when the crew feathered No. 2," 613 continued. "Of course, that put more work on the rest of my engines and as you might expect, No. 1 couldn't take it. It clobbered, too."

"Stuff was really stirred, huh?" 711 put in.

"It takes a lot to ruffle my aircraft commander but that was one time he figured he had trouble and to spare. The crew was pitching vital cargo like it was chewing-gum wrappers."

"One trip around the world shot, I'd say."

"Yeah, and nobody knows how close I was to diving one each plane complete with crew very deep into the Pacific. It just didn't seem worth the battle. We turned around but for the next five hours I was moanin' and groanin' and the commander was sweatin' and frettin.' "

"You can't win many like that. You never should have made the trip," 711 protested. "Didn't that smoke warn your crew? Don't you use Engine Trend Analysis at your base? Had you shown any other symptoms before?"

Six-Thirteen ignored all the questions but the last one. "I'd had some sharp pains in No. 2 engine before, and after each one, I'd feel weaker and weaker. My cylinder compression checks on about half a dozen jugs were going lower and lower. Dropping 70, 60, 45—and on the last check they were barely above the minimum. You'd think that would tell them something inside my engine was dogging and not long for this world. But you know how it is—as long as we can lift a wing, up and off we go!"

The Symptoms

"Jerking, jumping, jehosophat!" 711 exclaimed. "You had a trend that even I could read. High oil consumption, smoking engine, falling cylinder compression! Those engines should have gone for preventive maintenance before you made the trip. Instead, I guess they went to the graveyard when you got back. What did the post-mortem reveal? Lots of broken piston rings?"

"In No. 1, yes," 613 answered, "and, of course, small pieces of broken rings finally broke the piston lands. From then on it came apart at the seams."

"Now let me take a guess on No. 2," 711 requested. "You had plugged tappet drains and ended up swallowing an exhaust valve."

Six-Thirteen was visibly disap-

". . . it always got its cargo to the South Pole, the Orient, to Europe or someplace Stateside."

"It takes a lot to ruffle my Aircraft Commander. But he had trouble to spare."

pointed at having her story taken away, but surprised enough to ask, "How could you know that?"

"Your trend, girl, your trend!"

"You mean it's showing?"

"Every day it's showing. Your engines send a daily bulletin on their health. If someone receives information, makes a note of it and plots it on a chart, you've got a trend. Either this chart says the engines are well, which inspires confidence in the troops, or it will show up repeat occurrences of a hitch in your get-along. When these repeats occur, usually they are worse each time. That makes a rising curve on the chart, pointing out a trend of an unreliable and failure-prone engine."

"I guess you know what you're talking about," 613 stated, "but I sure don't."

Seven-Eleven was thoughtful a moment, searching for words. Then, "It's sort of like your aircraft commander saying today, 'My arm is sore.' Tomorrow, he says 'My arm feels worse than it did yesterday.' The next day he says, 'My arm is beginning to swell.' He's got a trend toward amputation. But if somebody has noticed these complaints he'll catch the trend and suggest that the commander see a doctor. The good doctor then digs out the infection, slaps some miracle drug and a band-aid on the spot, and the commander's arm gets well. On the other hand, if everyone disregards the minor ailment, the arm is apt to swell more, infect the man's entire body, and put him out of circulation. That's the message, Six, old girl, somebody has to heed the trend and do something corrective before your engines suffer inflight destruction."

Six-Thirteen was impressed but not ready to yield. "Have you included pre-med courses in your career development?"

"Nope, I'm just probably the wing's best eavesdropper, and there's a lot of conversation back in my home base on engine trend analysis. They believe in preventive maintenance and extending the lives of the engines. We've got so many old engines around they've formed a 'You're Only as Old as You Turn' club."

"Well, whizzo," 613 exclaimed, "but how is this preventive maintenance done? What's different about it?"

"We have regular post-flight checks."

"So do we."

"We have engine analyzer runs."

"So do we."

"We get our oil consumption recorded after each flight—how many quarts per hour we use per flight. Had a count just before I rolled in over here."

"Wouldn't you know I'd swallow valves?"

"That—we don't do," 613 stopped agreeing. "What difference does it make how much oil is used so long as I leave home with a full load on and still have some in the tank when I get back?"

"It isn't just measuring the oil that is important," 711 explained. "It's the individual engine performance picture that the maintenance people get after the oil consumption is measured and plotted for each and every engine."

"Sounds like a lot of trouble," 613 objected.

"Well, at first my crew figured it had enough paper work to do without taking a dipstick and measuring how much oil each engine used per flight and writing it down. Sometimes they'd forget, or sometimes they'd write in the wrong amount. But then a man from the head shed came out on the line and showed them what he did with their figures and explained how this helped everybody. He said, and I'll never forget these words as long as I fly, 'I plot the oil consumption figures on a linear graph whose parameters are quarts per hour versus engine hours.' He told the fellows that these records would help the Maintenance Squadron to spot an engine that needed minor repair and that this preventive maintenance would head off major troubles.

Keeping Records

"We went along with him after that—on keeping records. I remember that my engine oil consumption checked out about the same for two or three flights. One day, though, the chart man brought a piece of paper out and said, 'There's a rising curve on No. 4's oil consumption. Keep a close watch on it.'

"After another flight or two he came back insisting 'That the curve on No. 4 is climbing too high and too fast. The engine should come off and go to Maintenance.'

"But there was a mission scheduled and the squadron commander, Major Creasey, said he couldn't spare a plane just because somebody was jumping to conclusions. The chart fellow said, 'That engine won't last your mission and you've got another engine (No. 2) on the same plane that is beginning to smell.'

"That really sent Major Creasey! He barked, 'Here's a dollar that bets you're wrong on both counts. Now take your crystal ball and get out of here. We've got work to do.'

"That mission was a nightmare. Sure enough I came back with No. 4 feathered and creamed and No. 2 gasping. . . .

"I missed the next conversation," 711 picked up its story, "because that time the major went up on the hill to see the man with the graphs. I did hear some scuttlebutt around that the wing commander made him pay off the dollar—mounted on a piece of plexiglas — at the de-briefing critique."

"He should have been convinced that the records on oil consumption rates were worth something after that," 613 said.

"He was," 711 agreed. "He bought the program across the board. Records, strict and accurate, were kept and graphed. Maintenance men consulted these graphs and when one had a curve that said 'alert for trouble,' they pulled the engine and made a painstaking search for the specific item that was causing the trouble. They found broken piston rings, plugged pushrod tappet drains, worn exhaust valve guides, burned valves—the works! But they were able to correct all these little things before they gave the engines any grave problems.

"Just like the professor said—reliability is mighty cheap; if time is all it costs."

"About all I hear on the line now," 711 concluded, "is about what an efficient wing the 'Old Man' is running."

"I wish that our people would start an engine trend analysis program. I don't want any more of those two-engine sweat jobs."

"Give them the word when you go back."

"I wonder if I could. Now, let me see if I've got the picture. Individual records and graphs of engine oil consumption can spotlight an engine trend. If the chart indicates an engine is okay, as it ordinarily will, this assured reliability adds to the successful planning of assigned missions. When a chart shows an erratic curve, it means, 'This engine requires specialized and staff-supervised evaluation.' "

"Why, 613, you sound like the ol' professor himself. Be sure to tell 'em that it doesn't take much time to make these extra records and to correlate them. Also, that the engines that do get preventive maintenance are out only for a very short while and they come back to the plane ready to turn for many more hours. Tell them we don't want any more of these use-'em-while-they-last engines that go out to stay—and too often take one of us with 'em!"

Six-Thirteen yawned, "I've got to get my rest or I'll never make it tomorrow, but I'm very glad that we met again. I'll always say that I learned about engine trend analysis from you!"

"Carry on, 613. East is East and West is West, and one way or another we've got to tie the twain." ▲

The engines that get preventive maintenance are ones that are ready to turn for many hours.

REX SAYS

REDCAP 13, returning from a deployment mission, was nearing the end of an eight-hour flight. It had been one of those flights when a lot of little things happened that were irritating to the pilot even though none of them could be considered an emergency or as endangering the safety of the aircraft. First, an engine had to be shut down because of an overheat light, the UHF radio had been practically useless, several electrical storms had been penetrated and St. Elmo's fire was everywhere. Fortunately, there had been no difficulty in refueling, and the winds had been better than predicted.

As Redcap 13 neared its destination, the pilot contacted Approach Control for penetration instructions. The weather had been reported as 3000 scattered, 5500 broken, higher overcast and 15 miles visibility. There were several local electrical storms and radio reception still left a lot to be desired.

Approach Control acknowledged the pilot's initial call and asked if he desired to make the expedited jet penetration on the omnirange or the normal penetration on the low frequency range. The omnirange letdown had been approved locally but as yet had not been published in the Pilot's Handbook. The pilot, possibly influenced by the poor radio reception on the low frequency range, chose to make a penetration on the omnirange although he did not have a letdown chart for it. He requested and received from Approach Control the inbound and outbound headings, the penetration turn direction and altitude. When repeating the instructions, he stated: "*Right* penetration turn at 12,000 feet." Approach Control replied immediately: "Negative right penetration turn. Penetration turn to the *left* at 12,000 feet."

The next and last transmission from Redcap 13 indicated that it was leaving 4000 feet and turning to a heading of 078 degrees. Shortly thereafter, other pilots saw a brilliant flash on a nearby mountain peak. Redcap 13 had flown into the mountain and exploded.

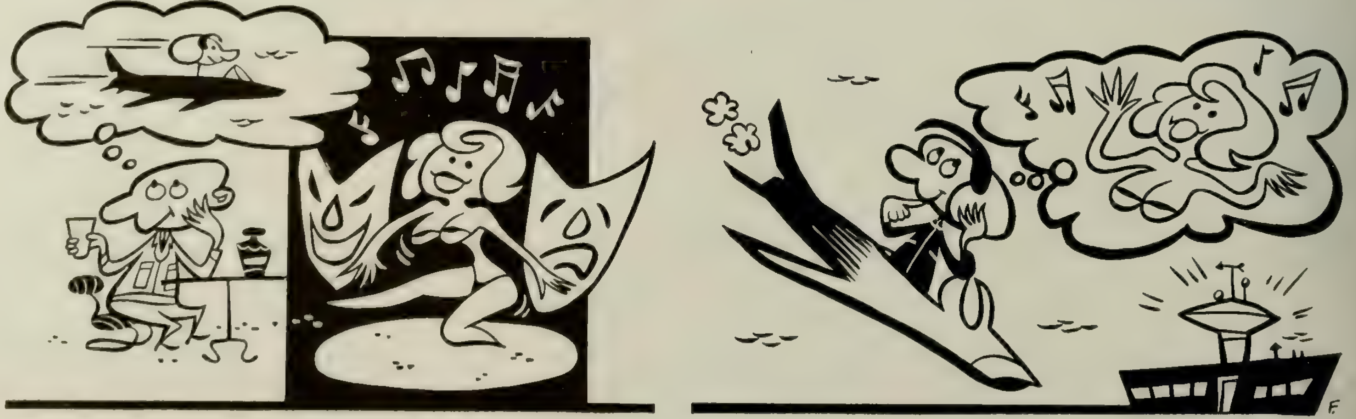
The Investigation Board determined that the primary cause of the accident was the pilot's attempt to perform a penetration turn in the wrong direction. It was believed that the pilot was possibly influenced by his knowledge of the fact that the penetration turn on the low frequency range is to the right. Other cause factors were:

- Approach Control authorized the use of a locally approved procedure which was not published in the Pilot's Handbook and therefore not available for review, prior to penetration.
- The Controller did not obtain the pilot's acknowledgment of the correct procedure.
- Poor radio reception.
- Existing weather which required a penetration from altitude.

***REX SAYS** — One of the cardinal rules for making an instrument flight*

TIPS FOR TIGERS

dream about Flying-BUT DON'T.... ....FLY ABOUT DREAMING



is to check your letdown charts for your destination and alternate, prior to taking off. In this case, there were no published charts for the OMNI penetration available to the pilot.

Air Force Regulation 60-16, requires that the base you are clearing to, under IFR conditions, be equipped with an operational navigational facility and the pilot have letdown charts in his possession. Certainly it is the intent of this regulation that the pilot have charts for the facility he is using when a base has more than one letdown procedure.

★ ★ ★

FOR THOSE of you who are still pushing the old pioneer F-80 around the pattern, here's a cool solution to a hot problem confronting a lieutenant recently.

The good lieutenant returned to his base for a landing one day with 200 gallons of JP-4 and a balky right landing gear which resisted every usual emergency lowering method known to the trade. In spite of libberal use of the hydraulic hand-pump, repeated recycling, skidding, rolling and judiciously applied G forces, the right gear warning light still refused to turn to that beloved green. The tower operator continued to report that the gear was most of the way down—but not in the lock position. With only 100 gallons of fuel remaining, the situation called for that 'extra something' most of us pilots hope to have when we need it.

In the pilot's own words, here's how he met the problem: "I made a rectangular pattern with about a mile long final. I cut the airspeed to 115 knots on my approach, maintaining about 70 per cent power. As I came to the runway I put the aircraft in a left skid and jumped the power to 80-90 per cent. Holding the plane in a normal landing attitude, and with its nose about 20 degrees to the right of the runway heading, I touched the gear down in a series of skips and bounces while at an airspeed of 105-110 knots. On about the third or fourth bounce, the green light came on and I performed a go-around. I made a normal landing and waited for pins before I taxied back to the ramp."

As fuel criticality is one of the most important lessons to be learned in the transition of pilots from the conventional to the jet aircraft, I feel that the point to be kept in mind is the way this pilot met his emergency. He was ready — first to go quickly through all the emergency procedures given in the Dash One and still have enough fuel left to try one more "trick" in the effort to save a costly airplane.

Gridley, to be eligible for a Well Done Award you must bring back the aircraft—intact.

REX SAYS*—With this lad's heads-up pilot technique, I'd say it's good to have him aboard.*

★ ★ ★

A FIGHTER PILOT was forced to use maximum braking action (short of blowing tires) during landing at a municipal airport. He taxied in and the alert crew parked the jet fighter in a highly congested area. The pilot was filling out the Form 781, the alert crew was standing by, when both wheels exploded. The shrapnel blew a three-foot hole in the side of a new F-101 parked next to the hot-foot fighter. Fortunately, no one was injured.

Naturally, maximum braking action should be avoided if at all possible; however, if the pilot is forced to use the brakes to the maximum, he should notify the tower and ask the alert crew to cool the brakes and tires before parking the aircraft in a congested area.

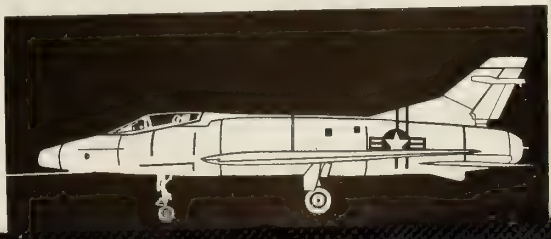
The F-100D Handbook has this to say on the subject:

"When approaching the wheel with cooling apparatus or for inspection purposes immediately after a maximum braking operation, the approach direction should be in the plane of wheel rotation to minimize personal damage from possible explosion.

"If compressed air blast is not available to cool the wheel and tire assemblies, water spray or CO_2 in short bursts of small amounts should be applied. EXTREME CAUTION must be used because the improper use of water spray or CO_2 can cause the wheel to explode.

"If immediate cooling is impossible, warn all personnel to remain clear of the wheel area because of the danger of wheel explosion."

REX SAYS*— And I say again, DON'T park that bird in a congested area until those brakes cool.*



UP or DOWN ?

TWO YEARS AGO the Directorate published a Study on Emergency Landings on Unprepared Surfaces which recommended that jet fighter aircraft land gear-down when making forced landings. This shook many pilots, since it was 180 degrees off from what they'd been taught.

Looking back over the past year it is apparent that the recommendation was valid, as injuries have decreased since pilots have been lowering the rollers. In 1956, 82 jet fighters (and trainers) force-landed on unprepared surfaces. Of the 82 accidents, 41 pilots landed wheels-down and 41 wheels-up.

Way to Injury

From the injury standpoint, 24 of the pilots who landed wheels-up had some degree of injury. Thirteen of the 24 had spinal injuries. Only 11 pilots (out of 41) were injured landing gear-down, and just one (of the 11) suffered a spinal injury.

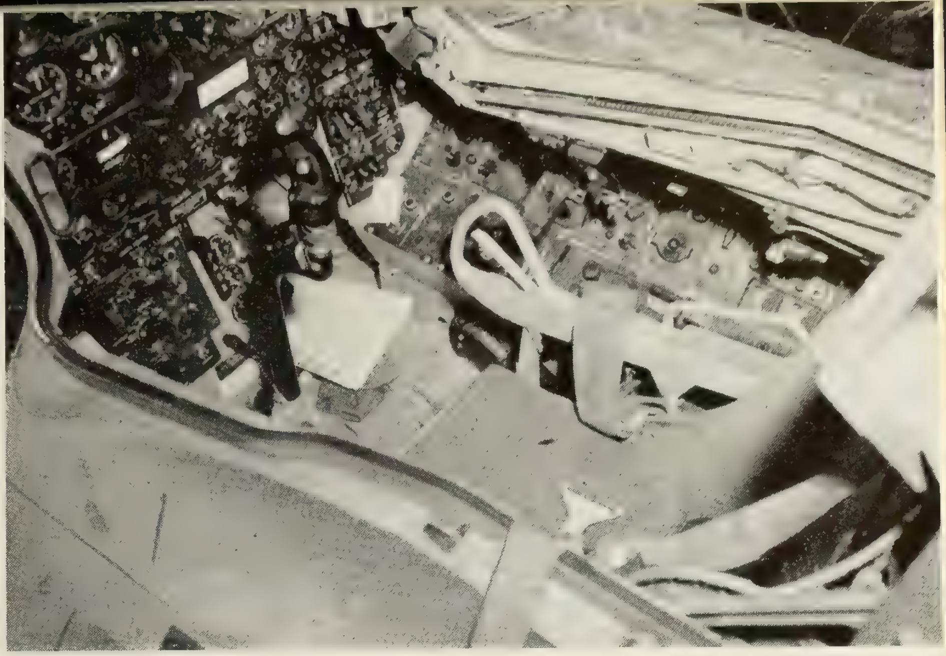
It's the same story on overshoots. There was a day when the recommended procedure was to "up" the gear when running out of runway. Of course, most fighter bases have runway barriers today. But take a look at the statistics on overshoots—of course not counting the barrier engagements. When the gear was retracted, 67 per cent of the pilots received some degree of injury. When the gear was left down, only 11 per cent of the pilots were injured.

On undershoots it's the same story—more pilots received injuries during gear-up landings than when the gear was down.

Left shows damage from accident below.

Getting back to the Special Study, at that time the recommendation did not apply to the F-89. It was possible for the Scorpion to trap the pilot when the bird landed off hard surfaces with the gear extended. The nose gear drag brace could be driven up into the cockpit distorting the floor whenever the nose gear strut failed.

About two years ago, an F-89 on a scramble mission aborted a takeoff because of a fire warning light. Since the remaining runway did not permit stopping, the pilot steered the aircraft into a snowbank paralleling the runway. The nose gear failed, driving the drag brace through the cockpit floor and pinning the pilot's legs to the instrument panel. Fortunately, the crash crew extinguished the resulting fire. The pilot was only slightly injured.



Damage to cockpit interior was eliminated. Compare above and below with pics on facing page.

The Straw

This accident was the one that broke the camel's back and triggered off a study of F-89 nose gear failures and subsequent cockpit floor distortion. The IBM machines started grinding out data and the results were startling.

Over a three-year period, 24 of these accidents had occurred. In each case the cockpit floor was ruptured by the drag brace. Sixteen of the accidents had happened within a nine months period.

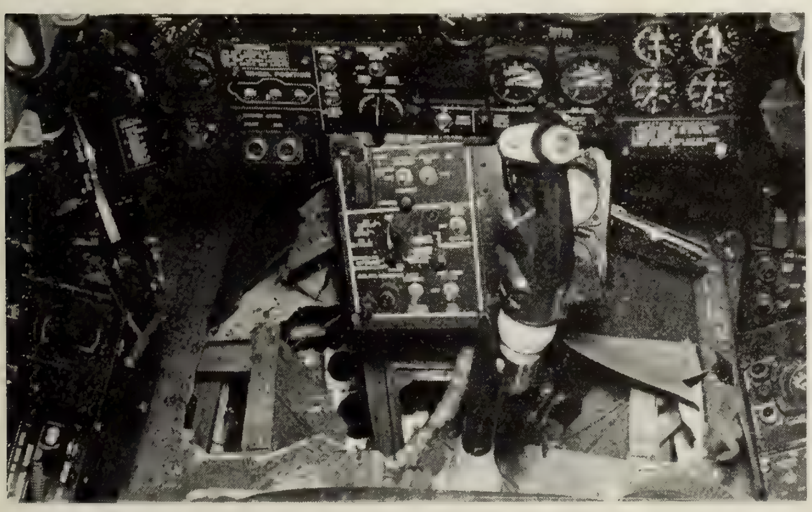
The prime AMA at first tried reworking the cockpit floor to beef it up. This didn't prevent the drag brace from entering the cockpit, however, and — well, there just wasn't enough room in it for both the pilot and the drag brace. So, the drag brace pin was redesigned.

Technical Order 1F-89-615 required replacement of the drag link lower pin with a close tolerance shear pin. The new shear pin is a hollow pin with a weak point that will shear under abnormal loads. A machined guide and two machined slides were added to make sure the drag brace folded flat on the nose gear strut when it failed instead of being driven through the cockpit floor. The accompanying pictures show the difference between what happens in a modified F-89, as compared to one that had not been modified.

From January through June of this year, four accidents occurred which involved nose gear failure on modified F-89 aircraft. In each, the pin sheared successfully and the drag brace did not rupture the cockpit floor.

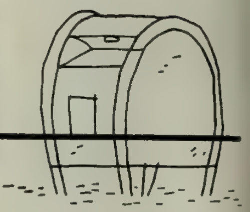
Safety of Flight Supplement Tech Order 1F-89D-1CL, published 12 Feb 57, now instructs F-89 pilots to make all landings with the gear extended, if T. O. 1F-89-615 has been complied with. ▲

Violent cases occurred prior to the modification. Your procedures are dictated by this.



CROSS FEED

LETTERS TO THE EDITOR



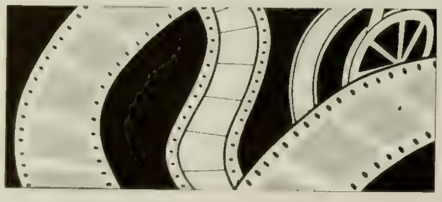
B-57 Flying Technique

In the June issue you published a letter from Capt. Paul R. Pitt which concerned single-engine flying technique on the B-57 aircraft.

This letter was accurate and to the point. I would like to add my endorsement to his comments and also suggest that any B-57 pilots that have not seen the film on single engine flying technique, which includes a scene of an attempted go-around on one engine with the tragic results, should see your Flight Safety Officer and ask for a showing at once.

If any of the B-57 Flight Safety Officers do not have a copy of this film I will be more than glad to send them one if they will write me directly. Obviously, we can only furnish them on a permanent basis to the units using the B-57 aircraft, although I would be glad to send them to other bases on loan, if so requested.

O. E. (Pat) Tibbs, Manager
Flight Test Dept &
Chief Test Pilot
The Martin Company



* * *

From Down Below

In your August 1957 issue, you published a letter from Major Larry Smith, USAF Exchange Officer, No. 82 Bomber Wing, Royal Australian Air Force, Australia, wherein the Major indicated a problem in obtaining and retaining copies of your magazine. The problem of retention seemed to arise from some crazy habit the Australians have of eagerly searching for and reading all world views and news, including FLYING SAFETY.

As an RAAF Officer, formerly of the 82d Bomber Wing, and now on Exchange Duty with the U. S. Air Force, allow me to do something to ease the Major's problem and to satisfy my brother officers' desire for broader knowledge. Enclosed find my check for one year's subscription to FLYING SAFETY. Copies to be forwarded direct to the Officer Commanding the 82d Bomber Wing RAAF, Amberley, Queensland, Australia.

David R. Smyth
Sqdn Ldr, RAAF
Mather AFB, Calif.

It's real nice of you to want to do something for your old outfit. All subscriptions, however, must be sent to the Superintendent of Documents, Government Printing Office, Washington 25, D. C.

* * *

10-Second Gear Warning

There has been much controversy recently concerning GCA glide path angles and threshold clearances, particularly with reference to C-124 type aircraft. I've worked a few C-124s and have observed many other (C-124) GCA approaches, and time after time and approach after approach I've seen pilots get into a hazardous situation by taking at face value the GCA 10-second gear warning prior to intercepting the glide path.

The following example is a typical and true incident. The aircraft number, the time and date are omitted, however, for obvious reasons.

The approach occurred at night during IFR conditions. The GCA final controller gave the C-124 pilot his 10-second warning approximately 10 seconds early, or 20 seconds prior to glide path interception. Ten seconds after the gear warning (the aircraft was still 10 seconds from actual glide path interception), the C-124 was observed to begin its descent and in less than a minute it was 150 feet below glide path and the final controller was turning gray-haired and blue in the face, trying to get the pilot to level off. Well, he did—finally—and the approach was completed without mishap.

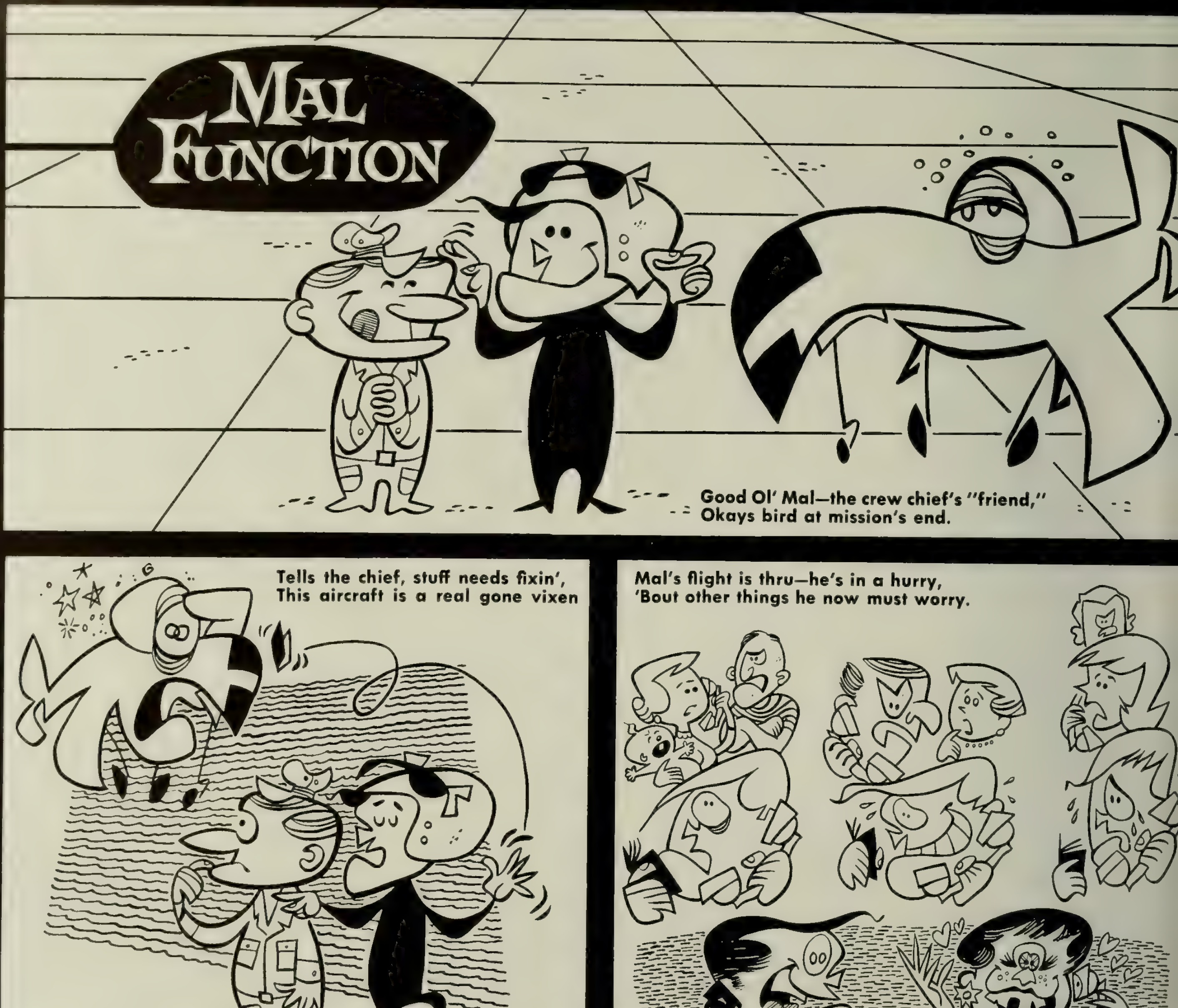
An incident of this type cannot be attributed to controller error. It must be understood by the pilot that a 10-second gear warning is an educated guess by the GCA final controller and may vary from five to 15 seconds. I think that pilots should be briefed that a 10-second gear warning does not necessarily mean that 10 seconds later the aircraft will be on the glide path and it is okay to commence a descent. The pilot should continue to follow GCA instructions and not try to "second-guess" the controller.

1st Lt. Eddie N. Nicholson
1961st AACS Sq, Clark AB.

Right. Doing what the man says is one thing—trying to anticipate his next transmission and over-eager action is something else. Take 'em as they come.

...Keep it in Shape!

Taking care of what you've got is not a matter of being all tied down. It's just plain good sense. This little doll is taking no chances. While that rope may temporarily restrict her freedom, it helps to keep her in shape. That's the way it is with good procedures. They may tend to hold you down sometimes. But you'll have what you want, when you need it — if you stay within the established limits.


MAL FUNCTION
Good Ol' Mal—the crew chief's "friend,"
Okays bird at mission's end.
Tells the chief, stuff needs fixin',
This aircraft is a real gone vixen
Mal's flight is thru—he's in a hurry,
'Bout other things he now must worry.
But crew chief, too, has much on mind,
He "ain't the reg'lar," y'know the kind.
FLIGHT ORDERS
MAL
Too bad for them they haven't heard,
Next day they fly this old-dog-bird.

*U. S. GOVERNMENT PRINTING OFFICE 441786

YS

OCTOBER 1957

FLYING SAFETY

UNITED STATES AIR FORCE

THE SKIES

THE LIBRARY OF THE
DEC 2 1957
UNIVERSITY OF ILLINOIS

Lieutenant General Elmer J. Rogers
The Inspector General USAF
Department of the Air Force

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Major General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Lieutenant Colonel Ralph R. Springer
Chief, Editorial Branch

•

Editor
Major Vernon R. Stutts

Assistant Editor
Major Francis D. Hessey

Managing Editor
William Johnston

Art Editor
M/Sgt Steven A. Hotch

Production
Major Ben H. Newby

Editorial Assistant
Amelia Askew

Distribution
WO Robert Blum

•

VOLUME THIRTEEN
NUMBER TEN

•

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished. Use of funds for printing this publication has been approved by the Secretary of the Air Force and the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the Flying Safety Magazine. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, Flying Safety Magazine, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use of material. Such action will insure complete accuracy of material, amended in light of most recent developments. The contents of this magazine are informational and should not be construed as regulations, technical orders or directives unless so stated.

The Editor's View

Times do change. Recently we've been hearing more about budgets than broads. While all this may be a healthy catharsis for the days to come, it's a little disturbing to live with. It's something like the weather—you have to live with what you get.

There's been many a lad who thought he'd never make it when first assigned to the dust ridden plains of Texas, and others who went to Thule with the same grim feeling. The heat of the Mojave, the rains of Seattle, the thunderstorms of Ohio, and the low ceilings of the Gulf States have all contributed their "restrictions," but we learned to fly through them. The same it is with the budget—a matter of learning how to live with it.

Your first solo ride through the smoothest of clouds was probably a hair-raising experience. Your first case of icing or sticky snow, a real spine tingler. But after the first brush, you began to see ways of living with the thing. You wanted to fly, and you did!

So how do we stretch a dollar? Knowledge of equipment stretches dollars. Planning stretches dollars.

No longer can we allow unsatisfactory conditions to go unnoticed. They shrink dollars. The savings realized by the timely correction of hazards is money in our bank—money that we can use to buy airplanes and flying time. Use of the U.R. is not only vital to the designer-manufacturer—maintainer of our birds, it is the same to us, the operators. Here, also, the Operational Hazard Report becomes more than ever a lifesaver. Through your near misfortune, you can help others as no one else can. By your awareness of conditions, you can organize and supervise your changing situation for the good of all.

So far, we have not done well in coping with our changing weather. On the day of this writing alone, four preliminary reports of major aircraft accidents in which weather was involved as a factor were received. Within the past forty-eight hour period, four costly aircraft have been destroyed; one pilot is dead and two others are at the moment listed as "Missing." In the case of two of the pilots involved, there is every indication that they were not qualified for the job they undertook to do.

We'll fly—because we want to fly. We can afford more flying if we do it more effectively and safely.

CONTENTS

Crossfeed 1
The Big Westerlies 2
Chain of Events 5
For Heaven's Sake 6
Just a Minute, Lieutenant 10
Iced T-Bird 13

USAF PERIODICAL 62-1.

CROSS FEED

LETTERS TO THE EDITOR

More Safety Tips

The June issue of FLYING SAFETY carries an article entitled "Springing the Trap." The following comments regarding additional safety features have been suggested by personnel of this Headquarters:

- A small painted plaque on the right side, advising that rescue instructions are shown on the opposite side of the aircraft.
- Replacement of the word "jettison" (which is military in nature) with one which would have more meaning to a civilian type rescuer, such as "free" or "throw."

The color coding of aviation fuels is another safety item that needs more emphasis. Instead of asking pilots to memorize the colors as suggested in various publications, it might be simpler to paint on the fuel cap the color of the aviation gas as normally used. Since the nozzle is inserted into the tank and the gas rarely seen during refueling, a small portion of the hose or nozzle could be of clear plastic in order to double check on the type of gas.

An EADF accident prevention letter pointed out that only one type (Mil-0-6081-1010) should be used in servicing F-86, F-89, F-94 and T-33 aircraft. The pilot and crew chief could do a better job of checking the correct servicing if the can and oil filler cap or dip stick were of the same color. They wouldn't have to depend on their memory of correct specification.

Capt. George H. Tully
Director of Flying Safety
Hq, 1st AF, Mitchel AFB.

Good ideas. Your suggestions have been forwarded to WADC.

★ ★ ★

Put it Back

Here's some information dealing with a problem that exists here and probably at other bases, too. I'd like to pass it on to all pilots, as a reminder. It's about charts. I was just reading an old, old copy of FLYING SAFETY (the July, 1956, issue) and came across your article entitled "Same Book, New Look," and decided to write you. I think it is a flight safety item.

A pilot will go out to his aircraft, make his check, climb aboard and take off. When he checks his Pilot's Handbook and finds one or more pages missing, maybe he wonders what has happened. Maybe he knows. Well, usually this is what happens: The pilot who has flown the aircraft previously may have the missing chart or page in his locker, flying suit, or perhaps has just said, "What the heck—they can replace it."

In the jet aircraft we have six handbooks—two jet and four low altitude, plus the Radio Facility Charts which number thirteen. It is asking a lot of the radio mechanic to check each page in all of these publications.

So, pilots, when you use one of these books, please be sure that you put it back in its proper place, and don't just stick it any place in the book, or in the aircraft, or in one of your pockets. This is for your own benefit as well as for your buddy, who may be the next pilot to fly the aircraft.

T/Sgt. Robt. J. Chancellor
3803d Com Sq, Maxwell AFB.

Good advice. It aids the radio mechanic . . . and you haven't lived 'til you've been diverted to another base—IFR—and find that the letdown procedure is missing.

★ ★ ★

Personal Equipment Quiz

This is about the August issue of FLYING SAFETY, specifically pages 14, 15, 16 and 17. I believe this to be one of the finest issues you've published.

Being responsible for maintenance, storage and issue of 1800 R1A Exposure Suits and B-5 Life Vests, plus 150 twenty-man life rafts, and numerous D-1 Kits, I have a warm, personal interest in your article. Throughout the years I have learned that one must read the fine print which, in your magazine, states: "The contents of this magazine are informational and should not be construed as regulations, tech orders or directives unless so stated."

On pages 15 and 18, you refer to T. O. 14S2-2-1, concerning the B-5 Life Vest. You imply that a B-5 Life Vest is not properly equipped unless signal flares are included. Paragraph 1f, Section VI, states, in part, that Pyrotechnic signals and mirrors are an optional item and may be installed at the discretion of the commanding officer. This is not submitted in an argumentative vein but merely to preclude many people from turning down a vest that does not have these items. This organization uses mirrors but not flares.

Flares are not used because they are a storage fire hazard; they damage the vests and are difficult to handle.

I regret that you did not mention the pilferage of articles from the life vests. In our business of mass transportation of passengers and cargo we find a high rate of loss of CO_2 cylinders, mirrors and flashlights. If these CO_2 cylinders could be converted to a semi-toxic gas, some of our light-fingered people would really have a hangover.

Keep up the fine articles.

Maj. George J. Thom
1705th Air TRANSGRU(HV)
PACD, MATS, McChord AFB.

★ ★ ★

Quiz Again

I don't want to be a nit-picker, BUT, in your personal equipment quiz (August 1957), item No. 5, you neglected a discrepancy which appears on the chest pack chute. Granted, the safety seal is broken and the canopy is exposed but did you notice that the left hand elastic band is missing?

1st Lt. E. E. Risedorph
AFROTC Det #670
Oklahoma State University

File Thirteen

This is the month of "The Skies"—as if you needed more proof than "Sputnik." And just as we predicted almost a year ago, this is the month in which world attention should be focused on the skies. There's more there than just weather. . . . Belayed by the budget was the Radio Facility Chart. From the 16 October issue on, you'll get one copy every four weeks rather than every two. Big effect on you is that late NOTAMS and like information are no longer available for those inflight changes of plan. Find out all there is to know before you leap and write it down. You might need it. . . . Some say the quick disconnect warning device restricts breathing after bailout. Figures. It works same as always. Thing is, it won't kill you if it's there, but it's possible for you to kill yourself if it isn't. Breathing may be rough, but it's better than no breath at all. Make sure it works before you leap. . . . Keep a sharp eye for changes in facilities. Ole budget gonna get some, and it may be "change without notice."

'Til November.

Vernon R. Stutts

You're either with them or against them. Here is a story designed to acquaint you better with . . .

The BIG WESTERLIES

Colonel Charles F. Blair, Jr., USAFR,
Pan American Airways

There's one particularly pleasant aspect in writing about the jet stream. It's not classified. Nor has anyone claimed to have invented it. A lot of us claim to have ridden it. I've ridden with it—or bucked against it—perhaps a few hundred times.

It's too bad we can't always fly from west to east, hitching a free ride, but this would involve a more or less complete circuit of the globe each time we set out to go somewhere. Such a procedure has its impractical aspects. Therefore we must buck this wind at times. Occasionally in our higher latitudes a jet stream can be found that flows the other way, from east to west, but the "big easterly" is somewhat rare outside the tropics.

In my own particular case there have been periods when I found myself bucking the "big westerlies" a disproportionate percentage of the time. Back in 1950, while suffering from delusions of persecution relative to these high altitude winds which, in a dastardly pattern, too often appeared on my nose, I was finally frustrated into acquiring an F-51 fighter which I rebuilt to fly up to 40,000 feet, with a range of some 4000 nautical miles.

With this airplane a fellow could lie in wait and suddenly pounce on a choice specimen of the North Atlantic jet stream. I simply requested the Pan American Airways meteorologist in New York to pin down one of these things between my regular runs to Europe for the airline.

He finally arose from his crystal ball and called to break up a bridge game one evening in January, 1951. It wasn't long before the F-51 was over mid-Atlantic on its way to London, nonstop. At 35,000 feet in mid-ocean there was indeed a fine specimen. For a short span of longitude there was a two-hundred knotter on the tail, at least so said the radarman on Weather Ship Charlie, who tracked my weary old fighter at 520 knots. Not bad for a fan-driven airplane.

But I had jumped the gun. During the following four days the North Atlantic winds kept mounting. On the fourth day a Pan Am Constellation out of Gander to Shannon experienced an average 130-knot tailwind over the entire 1735 nautical mile run, recording a 225-knot west-south-westerly breeze over Weather Ship Charlie at a mere 19,000 feet. The navigator of this flight carefully documented his data. This 138-knot average wind, to my knowledge, is the highest sustained long distance wind ever precisely recorded on the North Atlantic.

Major Mott Smith, USAF, flying a B-47 for the Cambridge Research Laboratories, found somewhat higher winds over the slightly longer transcontinental route during the past winter at altitudes above 35,000 feet. To find and record his wind data, Major Smith used a Doppler-radar coupled with an automatic computer.

Such Doppler equipment, incidentally, is soon going to revolutionize the business of finding jet streams. I have such a device on an F-84F jet fighter in which I do considerable flying on a special Air Force assignment. This equipment is a lightweight application of Doppler called RADAN. It continuously presents ground speed and drift on a standard three inch instrument, giving the pilot an immediate perception of his wind problem. In pursuit of my fighter navigational project I have had occasion to go looking for the big wind with the Doppler. The best I could find this year was a 150-knot westerly, and sure enough, I was

Most reliable of all is Pacific Stream. B-29 operators made this discovery in raids over Japan.

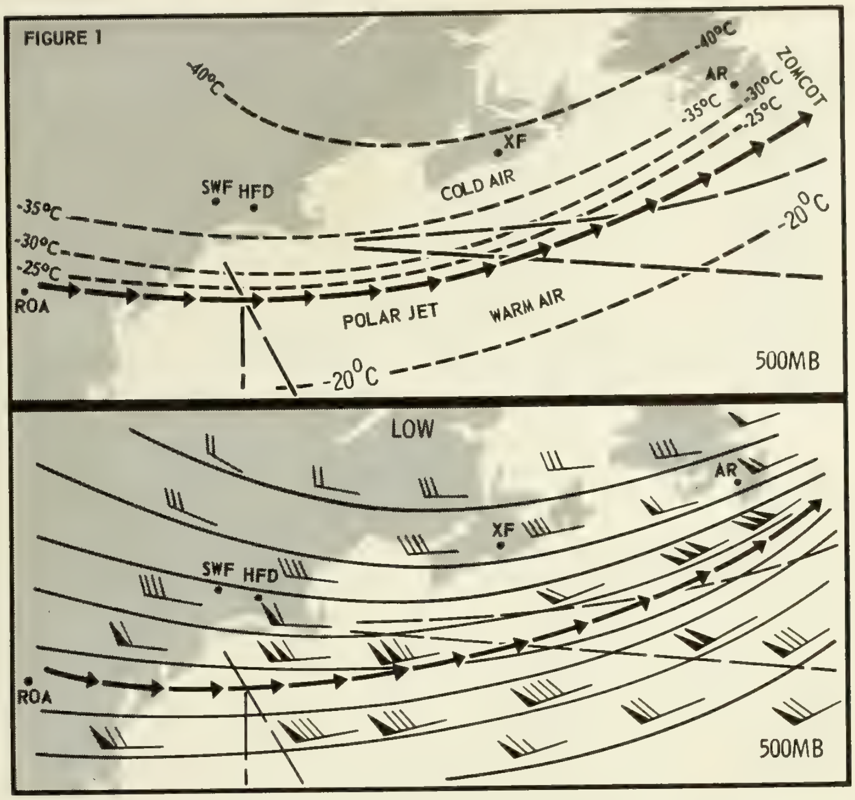
westbound—over Albuquerque. Two days later, while eastbound at the same spot, the wind had dwindled well out of the jet stream category, to a leisurely 40 knots.

This Doppler is going to help us in the jet transports. We'll ride the jet stream eastbound with precision and we'll do a better job of dodging it westbound.

Riding the jet stream on the airlines is not a new thing. We've been doing it for years on PanAm on the North and mid-Atlantic, as well as on the Pacific, using our forecasts, radio altimetry, and an air temperature gage.

Thanks to meteorologists, we're pinning down certain characteristics of the jet stream, harnessing it, so to speak, for useful work.

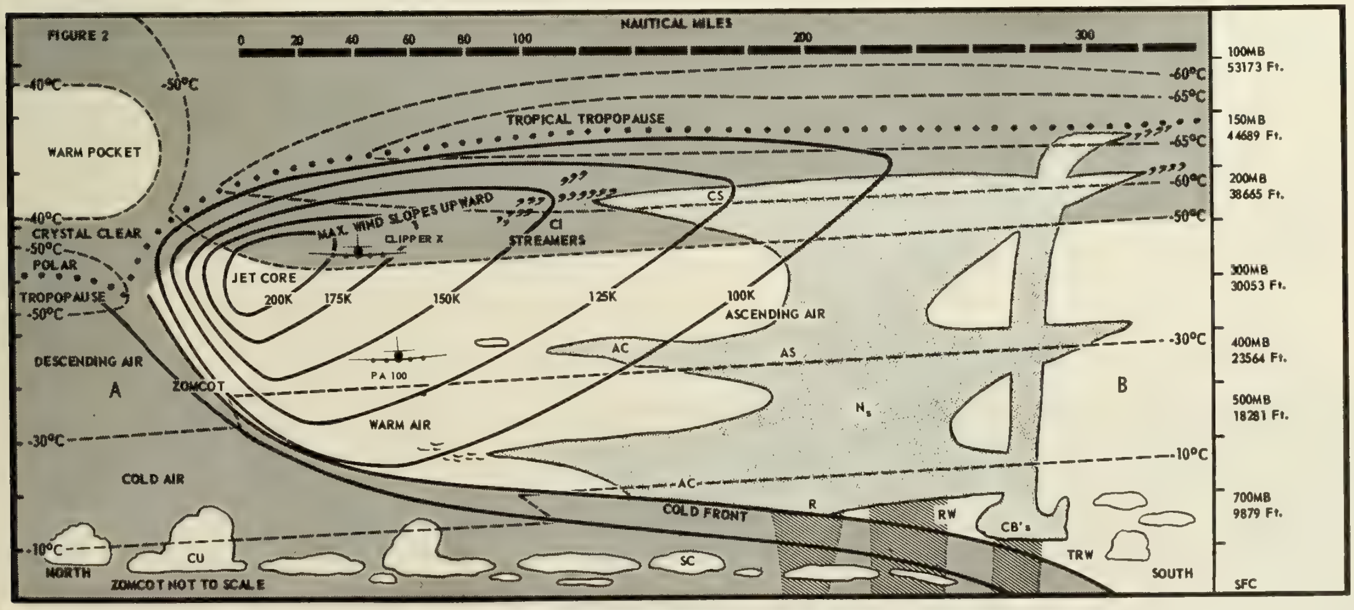
The Pacific stream has been found to be the most consistent and reliable. The B-29 operators in World War II first discovered this fact in their raids over Japan, finding themselves on occasion to be literally standing still while flying at high levels westbound. Nowadays our airline Stratocruisers hitch a free winter ride out of Tokyo to Honolulu, eliminating the stop at Wake Island.



Temperature contrast causes air acceleration. Compare wind velocities vs. temperatures.

These jet streams of the Atlantic, Pacific and elsewhere are associated with a meteorological phenomenon known as the Polar front. Although technically called Polar Jet Streams, these big winds are normally far to the south of the Polar regions, usually blowing their strongest in the mid-latitudes.

The simplest explanation of the Polar Jet Stream is Confluence. This is nothing more than the bringing together of cold and warm air masses which, under certain conditions, results in a sharp frontal boundary aloft. The greater the frontal discontinuity, the stronger the jet. This frontal zone aloft is sometimes labeled the ZOMCOT (Zone of Maximum Concentration of Temperature). This temperature contrast brings about a strong pressure gradient that causes an acceleration of the air quite simi-



Vertical cross section of Polar Jet Stream. Note greater wind shear toward colder air.

lar to a venturi effect. (Figure 1.) For true jet streams, a ZOMCOT must be parallel to the wind flow.

This venturi-like flow extends aloft, increasing in strength as long as the polar air remains colder than the adjacent air mass. Once the polar tropopause is reached, and at some level above, the horizontal thermal difference ceases. Here the core of the jet is reached. Above the jet core the temperature field reverses, which causes an abrupt decrease in strength of the wind. Therefore, as we climb into the stratosphere above the torrent of the core, we find ourselves in a region of relative calm. See Figure 2. (Please note a 20-to-1 distortion of the chart scale in its horizontal dimension.)

Generally speaking, the jet stream is a year-round phenomenon, being much stronger in winter and farther south than in the summer. Summer jets are relatively weak and, on the North Atlantic, for example, they move northward with the Polar front close to the Great Circle track between New York and London.

To navigate efficiently in relation to the jet stream, we must be aware of its general structure, particularly with reference to horizontal and vertical wind shear. Discussing horizontal wind shear and referring to the charts (Figures 1 and 2) we note that the Polar Jet Stream has much greater wind shear toward the cold air to the north, than toward the warm air south of the jet core. In some cases the shear to the north can be as much as three to four times greater than toward the south, which, incidentally, partly explains the clear air turbulence we find at times near the north boundary of the stream.

The vertical wind shear is greatest above the 25,000-foot level. An increase of 15 knots for each 1000-foot climb is not unusual when climbing below the core in the warm air immediately to the south of the Polar front. Right here the Doppler can be particularly handy.

In the case of the aforementioned 160-knot headwind over Albuquerque at 36,000 feet last winter, I descended to 30,000 with an eye on the groundspeed meter, and the other eyeball on the fuel-flow meter. At 30,000 feet there was a more reasonable set-up, the headwind having dwindled to 100 knots without too much of an increase in fuel-flow. This amounted to a vertical wind shear of 10 knots per thousand feet.

With a longer range aircraft I could have played the horizontal shear as well, probably cutting this 100-knot headwind to less than half by diverting to the north, but other conditions dictated otherwise.

On the North Atlantic we take particular advantage of this horizontal shear. In fact, it's a vital requirement. We simply can't afford to buck the extreme headwinds of a winter jet stream. A large percentage of our airline westbound flights proceed far to the north of the Great Circle track, in many cases into the sub-Arctic regions.

The above-described navigational technique is known as jet stream evasion. We also get involved in jet stream interception. Here again, we can operate in the vertical or horizontal plane. Either can reap large dividends, the climb paying off in particular when operating under the jet core. When flying in the cold air north of the Polar front, the horizontal deviation toward the southeast is our best payoff as we attempt to reach the warm air south of the front.

We probe for this horizontal bonanza with our air temperature gage, assisted by radio altimetry, Loran and celestial fixes, although as a matter of procedure we seldom take more than a 30-degree cut from flight plan track. A 30-degree cut usually figures at the best "yield per mile" of wind bonanza. There is a limit, of course, to the amount of probing around that we can do but the temperature as well as clear air turbulence, gives illuminating indications as to whether or not the probing to the south is worthwhile. Subsiding air, giving lower than normal airspeeds, may be another indication that we are on the north side of the jet.

Once we get into the warm air we find a band of strong winds which is often several hundred miles in width, with the strongest winds near the northern boundary of the warm air.

As we fly higher in the troposphere the band of strong winds normally widens. The jet core itself, high in the troposphere, is a narrow river in the sky, perhaps 25 to 50 miles in width and several thousand feet in depth. It sometimes reaches fantastic velocities, perhaps as high as 400 knots.

I would like to emphasize that finding these extreme wind velocities (in excess of 150 knots) is not a common thing. Furthermore it is a difficult matter to stay in the core of a jet for great distances, although with our coming Doppler and Inertial navigation equipment, we will find it somewhat easier.

My own best interception of a jet stream was in a jet fighter on a flight between Offutt, near Omaha, and Turner, at Albany, Georgia, flying a dog-leg south-south-easterly track to Jackson, Miss., and thence east to Turner. While approaching Jackson there was a moderate northwesterly on the tail, and then suddenly I noticed that my flying machine was blowing sideways and was no longer heading for Jackson.

Turning to the east, I clocked a 250-knotter on the tail. It is of interest to note that when penetrating the wind shear area from the north, there was no turbulence; not a ripple in the sky at 37,000 feet. On the ground below, the winds were reported to be dead calm. The night sky was cloudless.

Riding such a tailwind can be sporting and profitable, but it can have its unhealthy aspects for the blasé fellow who doesn't keep track of his checkpoints.

Bucking such a wind can be a deadly business in any aircraft, particularly when flying long distances over water. It helps to know when and how to get help, but above all, a pilot must know when and how to evade the jet stream. ▲

Nowadays airline Stratocruisers hitch free rides from Tokyo to Honolulu, eliminating Wake stop.

THE CHAIN OF EVENTS

Like the machine itself, *aircraft accidents are usually complex. They are rarely the result of any single mistake but rather the end product of a series of errors. Such a pile-up of unscheduled events can tax the ability of the pilot to a point where the accident is inevitable, like one which occurred in December, 1956. Although it was complicated by numerous contributing cause factors, the chain of events was triggered by an improperly executed penetration in weather.*

It's been said that truth is stranger than fiction and several true stories are currently gathering dust in a Hollywood studio because they are too fantastic to put on celluloid. As we follow these two pilots (one an IP) through the three hours and 12 minutes preceding their fatal accident, this fact becomes more than self-evident.

The T-Bird took off from a southern Air Force base on a routine, 60-2 training mission, at approximately 0830 that December morning. The total distance to destination was 1050 nautical miles; winds were not too bad at the proposed altitude, and a pleasant two hours and 25 minutes flight seemed in prospect. These pilots proceeded on course 1000 feet on-top, made routine position reports and experienced no difficulty whatsoever.

They were cleared by Air Route Traffic Control for a penetration at their destination and apparently trouble developed from that point on. Seven minutes after being cleared a GCI site in the vicinity picked up an emergency squawk on its weapon. ARTC reported that it was the T-33, east of destination, with ADF and OMNI out. About this time the pilots requested a steer from their destination tower but were advised the service was not available. Next, followed a period of intense conversation between the aircraft and tower.

The T-Bird reached VFR conditions at 1200 feet and then became lost. While the pilots were trying to establish their position by pilotage, an unsuccessful attempt was made to contact the local GCI site direct. This meant then that all headings and steers had to be relayed to the aircraft by their destination tower.

A DF station in the area tried to give the aircraft steers but the information was "rejected." The reason given was that the aircraft was too far out to use the airfield offering assistance.

The T-33 was given steers by various agencies, all of which were relayed through the tower and at one time. The pilots—by now, thoroughly confused—were actually within six miles of a suitable field. They called "flame-out" and looked for an open field to land. They were given wind direction and velocity and were asked again if they could make it to the air base. Their reply was No.

The T-Bird approached an open field downwind, overshot, and crashed in a wooded area only nine miles east of its original destination. Both pilots were killed.

A review of events leading up to the accident should start at the beginning of the penetration, since everything up to this point was normal.

Apparently the first error committed was by the pilot since he penetrated outbound on a heading other than that published in the Pilot's Handbook. After rolling out on the inbound headings, the ADF needle indicated that the aircraft was 80 degrees off track. This led the pilot to believe that his ADF was inoperative. The 80-degrees off-track indication by the ADF needle was correct because the aircraft was east of where it should have been. Based on his original decision that the ADF was inoperative, the pilot never again considered it an aid to navigation.

For the next 34 minutes (less the time it took to penetrate from 20,000 to 2500 feet), the pilots wandered around under a 1200- to 4700-foot ceiling in a vain attempt to locate the field. At least two GCI stations were available to them. They were given steers from 210 degrees to 295, and at one time were only six miles from a suitable landing field.

The last known level altitude *of the aircraft was 4700 feet above the ground when it flamed out. This was two minutes after its position had been plotted as being six miles from a suitable airport.*

Although the weather was not what is usually expected with a "weather" accident, it played a major role. It necessitated a penetration. It forced the pilots to descend to 1200 feet above the ground to maintain VFR, and from this altitude they couldn't locate the field. Indirectly, weather caused the pilot to mistrust his ADF.

So, it isn't always the "hairy" weather that can throw us a curve. In this case, for instance, the weather was mild, according to our All-Weather Air Force standards. However, two rated pilots (one of 'em an Instructor Pilot) did mill around for 34 minutes from start of penetration, under a 1200-foot ceiling and at times within six miles of a field, until they ran out of fuel and crashed. Furthermore, all of this happened over a heavily populated area where numerous suitable landing fields were available. Also, they had access to at least two GCI sites and one DF station, for assistance. Who said that "truth is stranger than fiction?"

For Heaven's Sake

The group was quiet. Even an outsider could have sensed the tension that penetrated that somber silence. As the seconds slowly ticked off, each in turn tried to break the suspense by tugging at his collar, squirming in his seat or nervously coughing. Each movement rewarded its author with a glare from the others. It was as though he'd committed a sin.

The silence was finally broken by the tumbling of the locking mechanism. The door opened. Every head turned to view the newcomer and eyes accustomed to noting details searched his countenance for a clue. The search was brief but it easily confirmed the rumors that had filled the air the entire morning. The front office was up in arms and there was going to be "U-no-what" to pay.

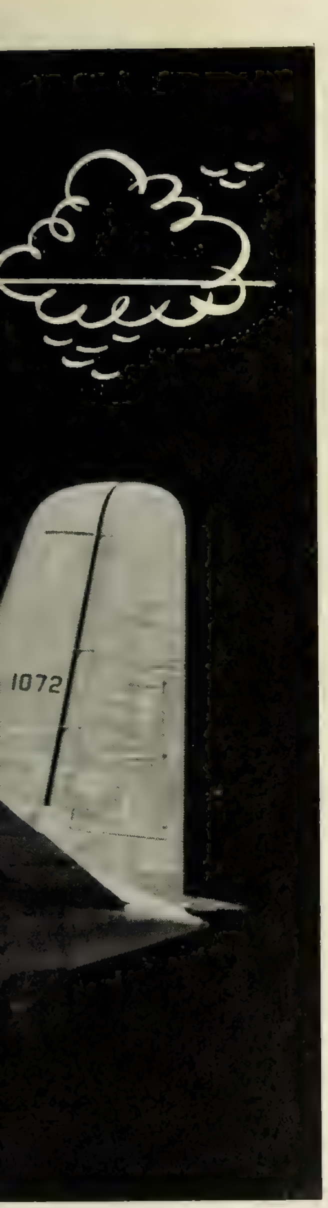
The brow of the newcomer was lined and his eyes narrowed in a frown that was a stranger to his otherwise benign face. He strode rapidly and determinedly—yet with elegant grace—to the seat at the head of the table. All eyes remained riveted upon him as he took his place. It was obvious that this was going to be a day that would tax the serenity of even an angel.

The newcomer was no stranger to the group. He was well known to airmen all over the universe. He was St. Christopher. The powers-that-be had, centuries ago, appointed him as patron saint of travelers.

Initially his position had been a minor one. His staff had consisted of just a few junior angels. Since the turn of the century his rise had been meteoric. It was now rumored that he would soon be given six star rank and placed directly under the Boss. The recent assignment of the Archangels Michael and Gabriel, aides to the front office, as his assistants really pointed up his growing status. One couldn't help remembering with a smile the little angel who once had been in charge of the ox cart travelers section.

St. Christopher's opening remarks brought everyone back to the moment.

"Gentlemen, I called this meeting



Here's a bit of whimsy you can't help but chuckle over. Submitted by "Lts. John Luke and Mark Matthew" of 7th Weather Group, AWS, a down-to-earth discussion.

because we are presently confronted with a problem area which, if not brought under control immediately, may become critical. The front office is really concerned about it and is putting on plenty of pressure to get results. I'll give you a clue, men, if we don't get results, there'll be the Devil to pay. I just attended a meeting up front and I can assure you that the Boss is shook up.

"St. Bernard, Deputy Chief of Staff for Housing, has advised the front office that unless something is done to cut down the inflow of new personnel, we will soon run out of quarters. Somehow the schedule has gotten out of hand. St. Peter has tightened his procedures at the Gate and insists that only authorized personnel can enter. He has no authority to turn away anyone who has the right credentials.

"The Plans Section places the blame on Materiel for letting those Wright Brothers have that airplane. But Materiel has a DF indicating Operations approval of the issue so there is nothing to be gained by pursuing that angle.

"After much discussion it was decided that there were overlapping responsibilities between my Travelers Aide Staff and the Guardian Angels, (Air Division) and it was front office opinion that we should reorganize by placing the latter under my control. So I am now the angel on the spot and I expect results. I am not too familiar with your problems but I do know the front office thinks you've fallen down on the job. So what about it?"

For a moment there was silence. Then a large, robust angel near the end of the table stood up.

"Sir," he began, "as head of the Four Engine Branch—reciprocating, that is—I'd like to say a few words. First, I guess you know we are underangeled in our section. We have plenty of recruits and a good OJT program. But most of these newcomers are fellows who goofed on earth, and we have to really check them over carefully before we can turn them loose and assign them to an earthling airman.

"Their shortcomings, coupled with the caliber of airmen we are being assigned to, makes me think we're putting in lots of flying hours on a hopeless task. I think someone should investigate the Ingredients Branch of the Mankind Propagation Division under Personnel. I don't think they're issuing the same number or quality of brain cells they used to. It's a

He strode rapidly and determinedly to the head of the table. It was obvious that this was a day that would tax the serenity of an angel.

tough job to watch over a chap who won't use the intelligence the Boss gave him.

"Let me give you a 'for instance.' I won't bother with inflight emergencies or anything serious. My case is one where the goof was made before we even got off the ground. I was assigned to this four-engine jockey last week, his regular angel being on leave. He filled out a 175 and went into weather for a briefing. He had to wait a minute since the forecaster was briefing a jet pilot.

"As he waited he checked the sequences and saw that his destination was clear and 10, negative perspiration! When his turn came for briefing, he turned down his hearing aid and got on cloud seven for an ecstatic few thoughts of home, et cetera.

"He didn't hear the forecaster say that while the situation was good, now, they were forecasting fog for his ETA, not only at his destination but all along the coast, back to the mountains.

"Well, to cut a story short, we got off the ground. I checked with the Forecast Branch and was told that they were going to let the forecast verify so I had to go to work on this chap. I finally got him bored enough to read the Radio Facility Chart. Even got him to look at the page covering the area adjacent to that of his destination. I gave him a terrific belt to have him notice that a station en route had Pilot-to-Forecaster Service. But no matter what I did I couldn't get him to call the station, although he did ask the copilot what the letters 'PFSV' meant. I broke three conscience needles on him.

"I won't bother you with the gory details or the chaos that ensued on our arrival at destination or at either of the two alternates we used, or what happened when we finally just made it into a small field in the hills. My point is, what can we do in a case like that? Here we have a chap who thinks he knows all about weather, and completely ignores the weather briefing. If attentiveness to weather briefings was a prerequisite to getting up here, this guy wouldn't make it. In fact, if he does get in, I'm going to insist he get a cloud-pounder's job. If he gets wings, I'll FEB him immediately. I swear. . . ."

The grey-haired angel at the center of the table cut in just in time. "I agree with the four-engine people. We have the same problem in the Gooney Bird Section. Just yesterday, my boy made a trip from Andrews to Patrick. He got a good weather briefing — route okay, destination CAVU. What he didn't hear—as he collected for flight lunches — was 'headwinds at flight altitude 75-95 knots.'

"Well, we made it, but had to stop at Savannah for gas. And, believe me, downstairs hath no fury like a chap trying to land that crate in a 40-knot crosswind. I dang near had to pull a miracle to get him down okay. It was the last miracle he had coming too.

"What burns me up, and the very thought of that makes me shudder, is that I almost got airsick because of the turbulence. You see, we paralleled a cold front all the way. If my boy had listened to the forecaster describing the synoptic situation and used his head, we would have lit out about 70 miles west, flown behind the front with a terrific tailwind and less turbulence, and made it without that miracle-begging landing at Hunter.

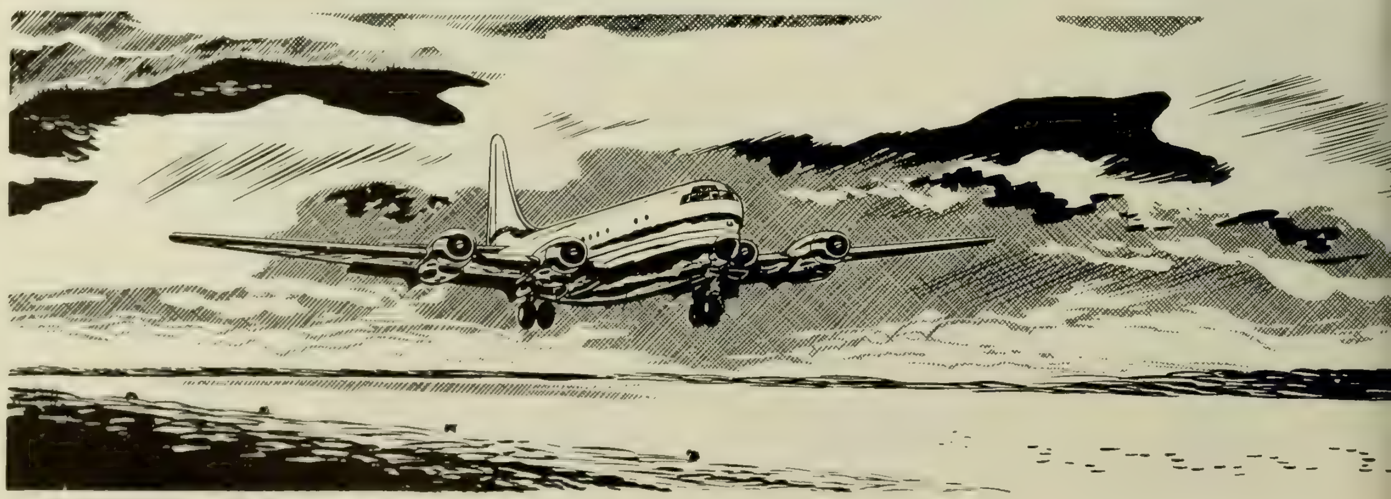
"Chief, too many of these fly boys whom we have to protect, think that weather briefings are necessary evils, and they don't use them to plan their flight. They commit themselves to a certain flight plan, then get the weather, instead of getting the weather and then planning a good flight. This apprentice I'm breaking in now did the same thing, but his quota of miracles had run out.

"I think my four-engine friend has a point, but you're beating your head against the clouds if you think you can get the Ingredients Branch to change the formula on brain cells. They can prove the issue is adequate, and that it's mismanagement that causes the trouble. I think maybe a better solution is to check with the Scientific Services Directorate and get them to step up the forecast verification to 100 per cent. Maybe if the weatherman is always right, the pilots will pay more attention."

"You're wasting your time on that, Chief," spoke up a bespectacled, long-haired angel from the end of the table. "As Staff Weather Officer for the Guardian Angels, I've already talked to them about that. They claim the present schedule for meteorological progress will be maintained. While they are willing to let the forecaster be right most of the time, particularly in good weather, they insist that he must still make mistakes. They refuse to let him approach perfection until he has done a lot more research.

"They vehemently insist that with Pilot-to-Forecaster Service, the pilots

"I broke three conscience needles on him, and we finally just made it into this small field in the hills."



can check on the forecast periodically and get confirmation of the original —or a revision of it as necessary— and if they don't do it, it's not the fault of Scientific Services. The Operations people have allowed the forecasters—in fact, told them—to advise the pilots of stations en route with Pilot-to-Forecaster Service. This decision to stick to the present scientific schedule has front office approval so if you want to buck that, you may bring down the wrath of the Boss upon yourself. I got my wings clipped just going as far as the Chief of Staff on it."

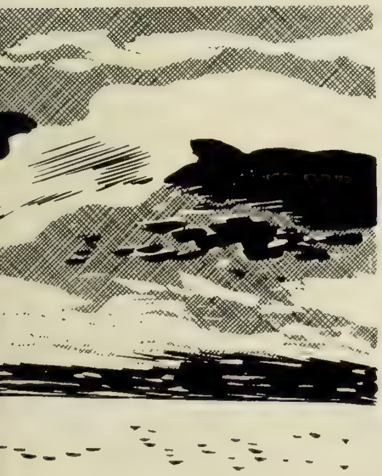
"Okay," cut in St. Christopher, "I guess we can't upset the whole universe system. But —."

St. Christopher was interrupted at that point as the door opened and Archangels Michael and Gabriel entered, supporting a be-draggled, blood-smeared, bent-wing angel whose appearance gave every evidence of another accident.

"Holy Smoke — Oops, sorry," exclaimed and apologized the Gooney Bird angel. "That's Angel Jonathan of the Jet Division."

"The front office thought you might want to see him right away. The medics gave him an ambrosia pill and a nectar shot, so he should be coming around pretty soon. Actually, he's suffering more from shock than injuries." As he spoke, Archangel Michael eased Angel Jonathan into a chair. He and Gabriel left the room.

Angel Jonathan slowly opened his eyes. They gradually roamed around the room as he became conscious of where he was. Finally his eyes rested on St. Christopher. "Chief, I've had it. I need a transfer. How about letting me go back to the Bicycle Division."



"Take it easy, now, Johnny," replied St. Christopher, "from your appearance and condition, I would say we have some new basic angels down at the Gate."

"Yes, unfortunately we have. But that isn't the reason I got this way. I guess I'll get court-martialed for this, but maybe a couple of Centuries stoking the furnace downstairs is worth it."

"What are you talking about?"

"Well, let me start on the beginning. I just got assigned to this junior birdman down at Scott. He was my first jet assignment, you know. Well, he had a full-time desk job so his proficiency as a pilot wasn't the best. He decided to go down to Warner-Robins and got himself a T-Bird for the trip. On the 175, he entered his flight altitude as 4000 feet! I immediately got shook up about that. Then, we went into the weather station and he was told he was going right through one of those Severe Weather Warning Areas.

"**He took the news** without a flinch. I thought the fluttering of my wings when the forecaster said, 'tornadoes forecasted and already reported' would wake him up, but no. Well, to make a long story short, we took off and when we ran into the thunderstorms, he headed down trying to get underneath. Well, he finally did. But it was a couple feet of ground instead of clouds.

"I couldn't see my way clear to waste a miracle on that chap. But I got real mad about this and I went back to our departure point. What I couldn't understand is why this guy got cleared for a flight altitude of 4000 feet and through a tornado area where the weather was already occurring. It seems to me that the clearance authorities in this case had fallen down on the job. I can't see how they can perform their functions, unless they are aware of the areas of marginal weather.

"I've seen too many of these base ops people and AOs do a whole day's work and never go into the weather station for a briefing. Then they check a Form 175 and I don't know what they do—I guess just check to see that all the boxes have something in 'em. They sure as 'downstairs' can't evaluate the weather effects on the flight.

"The Form 175 is designed to let the forecaster give the pilot and the clearing authority a reminder of the weather. In itself it isn't enough. It must be supported by a knoweldge of the general situation. Then it can serve a purpose."

"You've got a good point there," cut in St. Christopher. "I'll get after the ops people on that. It's pretty clear that the Supervisor's Guardian Angels aren't up on their toes."

"That's what I told this Angel who was assigned to the clearance officer at Scott. Then when I found out he had been sleeping on the job, I lost my head and let him have it. They say he'll recover, but I guess I'm going to have to face an angel assault charge."

"I'm on your side," spoke up the bespectacled, long-haired angel. "I can't see why the forecasters have to fill out the Section D of the 175 unless ops people are going to use it."

At that moment a red-capped angel entered the room and whispered something behind his wing to St. Christopher, then withdrew.

"Well, gentlemen, a crisis has just arisen in the Ground Safety Section which I'm going to have to get on right away. Meanwhile I want all of the Guardian Angels in all aircraft sections to review their procedures. Use your checklists. And literally and figuratively, for Heaven's sake, use the Tech Order and stick to it.

"**On these matters** concerning weather, sharpen your needles and if your assignees don't plan their flights according to the weather briefing, or if they let their attention wander during briefings, let them have it right where it hurts the most! And, for the Boss' sake get them to check in on Pilot-to-Forecaster Service for a new forecast before they commit themselves to proceeding into questionable weather. It will save them and help your ulcers.

"And remember, it isn't the latest observation they want—that's history. Keep that needle working until they ask for the latest forecast. Meanwhile, I'll get together with the Operations Guardian Angels and see if we can't get them working harder on the supervisors. Now, let's get to work. I want results! Or you'll all be out pushing clouds around!

"Oh, one last word. Keep your eyes open when you're flying around up here. Traffic's getting pretty thick these days. A mid-air collision up here and we'll all lose our wings." ▲

"Just a minute

Major William L. Dod

There is not an instrument available that can give a more representative picture of weather upstairs than you can. Where other eyes cannot see, you have to take over.

It was a typical early Tuesday night in a very typical Officers' Club bar. First Lieutenant George Appleby was idly stirring his drink with his finger. He looked around the room. Yep, it was real typical. He could spot the "regulars" right away. They're all the same. And, he could tell the lonely TDY types. The eager look.

He was on TDY himself. Just killing time. Weather socked in all around. Real bad. He looked at his watch, polished off his drink and turned on the bar stool. He bumped into another first lieutenant. They looked at each other and Appleby started to apologize. He was interrupted by a big grin and an outstretched hand.

"George Appleby, you old knucklehead. Haven't seen you since flying school."

"Ed! Ed Thompson! Man, I'd forgotten you were stationed here. Am I glad to see you! I was looking forward to an evening full of nothing to do."

Thompson's grin widened. He climbed on an adjoining stool. "What'll you have, George?"

Appleby ordered another of the same, Thompson called for an imported beer and the dice.

While they were "horsing," Thompson said, "George, I'm sure glad I decided to stop in for a quick one. Say, I'm fixin' to call up a dolly. Want me to see if she's got a friend?"

George smiled. "Yeah, why don't you do that little thing. But, like the fella used to say, 'Let's eat first.' "

"Good show," Ed said, as he winked. "Let's order another and have the waitress bring them in to us. He turned to the bartender, "Two more of the same and have Gloria bring them in to the dining room!"

The two men climbed off the bar stools and walked to the other room. Everyone seemed to have had the same idea at the same time and all the tables were filled. They waited for about five minutes and then got a table for four, just as the waitress brought in the drinks.

"Excellent timing, Gloria," Ed said. "It looks like we'll be doing a bit of waiting so why don't you bring us a couple more, in about ten minutes?"

"Very well, Sir!" Gloria jiggled out of the room. Both men watched her leave. Ed looked at George, "George, I'm with you." Both men laughed as they looked over the menu.

Their thoughts were interrupted as the hostess came up to their table. "Gentlemen, would you mind if another officer joined you? We are a bit crowded this evening."

Ed looked at George, then looked at the hostess. "Certainly not, Miss, we'd be delighted."

The hostess motioned to a gentleman standing by the cash register. He came over. Both lieutenants stood up and introduced themselves to an apologetic El-Cee.

"I'm Colonel Dale, gentlemen, I hope I'm not intruding too much."

"Not at all, Sir, it's a pleasure to have you join us," Ed replied, looking at George. The Colonel scrutinized the menu carefully. Ed turned to George again.

"You never did tell me what you were doing here, George."

"Ed, there's a lot of places I'd rather be. Wasn't supposed to be here at all. I owe it all to a busted forecast. The clown who briefed us on the weather fouled us up, but good.

"Us?"

"**Yeah, I was flying a bird colonel** to Washington. Got a T-Bird. The Forecaster told us we'd run into a weak front, west of Washington, just about ETA time. Ed, we ran into a line of thunderstorms that shook us every way but loose. I finally came in here when the fuel ran low. Colonel got shook and decided to stay here for a couple of days. Said he's got business."

Ed sympathized, "Some of those jokers ought to be in a carnival tent. I've seen Gypsies who can guess better than most of those guys!"

George interrupted, "Can you figger it, a weak front, he says, and I hit some tops that went above 40 thousand!"

Ed, not wanting to be outdone, came on strong. "There's a weather guesser on one of my runs who's going to be looking for a new head one of these days. Not that he

Lieutenant...

9th Weather Group, AWS

doesn't need one! He's on an island out in the Atlantic. You'd think they'd take pretty good care of us MATS types. They're in MATS, too!"

George laughed, "I always thought they were in a world by themselves."

"Brother, I had a load of passengers on my last run who feel that airplanes are a child of a disordered brain. I can't blame 'em either. We were all over the sky, missed the ETA by 20 minutes. Even the steward got sick. And this weather joker told us we'd have some scattered buildups!"

"It was just like your flight, George, they call for light turbulence and icing. We end up with moderate to heavy. Had to pick our way through with radar. We were going to turn in an Operational Hazard Report (OHR) on the whole deal but the aircraft commander was in a hurry to get home so we didn't mess with it."

The conversation continued, each man trying to outdo the other, as he recounted hairy tales of weathermen. Parentage was discussed and various torture treatments were bandied about.

The waitress broke up the session by bringing their orders. The break didn't last very long. Just as George started off on another talk, punctuating his remarks with his fork, the LC broke in.

"**Just a minute, Lieutenant.** I've been sitting here for 20 minutes, listening to this utter nonsense. To hear you men talk, you'd think the weatherman's mother and father were first cousins!"

George looked at Ed. This look said, "Mebbe we were talking when we should have been listening."

Ed flashed back the same look as he attacked his steak vigorously.

The Colonel was far from through.

"Gentlemen," he said, "I'm not pretending that weathermen are perfect. Far from it. But, I'm curious as to how much help you pilots give the weather people.

"For instance, when you hit a ceiling at 600 instead of the forecast one-thousand, do you tell the tower so he can tell the weather boys? And you, Lieutenant, when you were trying to get into Andrews today, did you call the forecaster on Channel 13 and and tell him of the buildups? Did you ask for weather conditions in other areas?

George looked at his plate. "No, Sir."

"I thought not. And you, Lieutenant Thompson, did the AIREP you sent out contain information on the icing and turbulence you encountered? I'll bet it didn't."

The colonel paused and had a drink of water.

"I'll bet neither of you gave the forecaster a briefing on the weather that you encountered—either in the air or when you landed."

Both Lieutenants continued eating as the Colonel pointed out a few other things. When they had finished, the Colonel called over a waitress, ordered a round of drinks "for my friends here." He lit up a cigar, got comfortable. Ed and George looked at their watches. It was apparent that their dates, if any, would be late ones.

"Gentlemen, the Air Weather Service maintains a continuous program aimed at getting you flying types to make pilot reports. Admittedly, weather forecasting isn't an exact science and AWS needs everyone's help to make it as exact as possible.

"It makes no difference where you are flying—over the ocean or in the local area. Your observation of the weather is a vital cog in the weather forecasting machinery.

"The high-dome boys are working hard to reach the ultimate in exactness. But—they've got a long way to go. We've come a long way during the past few years but there still are too many 'Xs' to make the equation come out with a 'pat' answer.

"Thompson, you do most of your flying over the Atlantic so let's look at that area for a while. Suppose you MATS boys and the airline pilots didn't send out AIREPS. What would the weathermen have to work with?"

Ed started to speak, "I never thought—."

"Yes, Thompson, I'm sure of that! But you've got to remember that a weather forecaster in that area has but eight stationary weather ships to rely on. Of course, he's got Bermuda and Lajes and some commercial surface vessels—but that's all.

"**He has to forecast cloud tops,** turbulence, icing, winds, et cetera from the data obtained by rawinsonde runs made by the people I've just mentioned. Give a young weatherman a map with holes in it as big as the eastern half of the United States and his imagination can run wild.

"Of course, the old 'heads' can give you a good forecast using the crystal ball they've acquired through experience. But the inexperienced types can and do earn themselves some OHR clusters."

Ed broke in. "How about the weather recon outfits? We're always hearing about them."

"Glad you asked, Thompson, I was just getting to them. There are two outfits, as you know. The 59th Weather Recon Squadron is at Bermuda and the 53rd is at Burtonwood, England. The men in those units go out and fly 14 hours over areas you people don't cover.

"**The information they send** in is as accurate and as valuable to the forecaster as the information received from the local and ship stations. The forecaster counts on you to fill in those big holes where Recon doesn't operate.

"Every wind forecast, every cross-section, and those new horizontal weather depiction charts are all made up from a careful review and analysis of all information the forecaster receives. Then, too, a lot of this information is sent in to Washington for the 'Big Picture.' "

All three men laughed and George sneaked a look at his watch. He then sneaked a look at Ed and the two men started to rise.

"Sit still, gentlemen, I'll order another round." The two young officers sat down, reluctantly.

The Colonel called the waitress over, ordered, lit another cigar and began again.

"Let's get back to the States for a while. There's pretty good coverage of upper air and surface station here in the ZI. The weather people can give you a good forecast for your winds. As yet, though, they don't have equipment which will give them the picture that you can give them.

"The CPS-9 weather radar sets—I'm sure you've seen them — can locate heavy cumulus or convective clouds. They can even give a fair picture of the tops. But—and this is an important but—they can't give a picture of the degree of turbulence within the clouds. They can't tell how much or what kind of icing is in the clouds. And they can't clearly define the amount of clouds or their bases and tops.

"A rawinsonde run—when plotted up on an adiabatic diagram—can give the forecaster information on what should be present up there. But, unless they start putting people in weather balloons, you fly-boys are the only ones who can positively confirm the conditions.

"The observer on the ground can only report what he can see. The worse the weather naturally the less he can see and the smaller his representative area will be. The Representative Observation Program, designed by the Air Weather Service, puts the observer in the area you're most interested in. And that's the approach end of the instrument runway.

"**With winter just around the corner,** there'll be plenty of days when that observer will only be reporting the weather in that small area. Where the limits of his eyesight ends, your eyes have to take over.

"Gentlemen, there isn't an instrument now available that can give a more representative picture of the weather aloft than you can. The forecaster needs pilot reports. If what you encounter is according to his forecast, he wants to know. Conversely, if he 'busts one,' he also wants to know.

"Don't wait to give that pilot report. Give it to someone as soon as you can—to Air Traffic Control, Approach Control or to the Control Tower. And, don't forget Channel 13! Give it directly to the weather forecaster on the Pilot-to-Forecaster Service. That's Channel 13.

"The next time you're in base ops, ask the weatherman for a copy of the new Form 36. Air Weather Service has just published it. On one side you'll see the location of Channel 13 sets and CPS-9 weather radar sets. Both of these are listed for the ZI. The other side has a checklist to use for inflight pilot reports. You should turn in this form with your Form 175 when you land."

The Colonel cleared his throat, "Guess I've been hogging the conversation, haven't I?"

Before either George or Ed could say, "Roger," the Colonel put out his hand, "Nice meeting you gentlemen. Hope you'll be more kind to weathermen in the future." He was smiling as he left the room.

George looked at Ed. "Whew," he said, "haven't had a lecture like that since ground school." He looked at his watch. "Hey, Ed, get on that telephone. The Colonel is only going to be here for two days. This is my night to howl."

"Ed was scratching his head. Suddenly his face broke into a grin. "Been trying to figger out who that troop is. Just came to me. He's the Weather Detachment Commander here. No wonder he made such a pitch!"

"Yeah, okay, good show, roger, I'll remember what he said. But, you, you clown, get on that phone and do some pitching of your own."

It was a typical late Tuesday night in a very typical Officers' Club bar. First Lieutenant George Appleby was idly stirring his drink with his finger. He looked around the room. Yep, it was real typical. He could spot the "regulars" right away. They're all the same. And he could tell the lonely TDY types. The eager look.

George looked in the bar mirror. Liked what he saw. Clean cut American boy type. On TDY. Real eager look. Lonely? No, sir, he had a friend, and the friend had a friend with a friend. What's better than that? ▲

Iced T-Bird

tips for tigers

There's something definitely paradoxical about this fly safe business. Oftentimes we have to experience an accident or a series of them in order to fly more safely. Of course, that's just another way of saying, "experience being the best teacher."

Once a trend is established, the smart folks in the business usually get their heads together and think. They talk to other people, read the manuals, conduct tests, manipulate the slipsticks, get out the computers and mebbe even burn some midnight oil.

Just such a deal happened recently up at Headquarters Northeast Air Command, and if a colder and icier area exists anywhere, the NEAC-ers are going to need a lot of convincing. This one concerned icing on T-Birds and F-94s. Here's the pitch.

A series of accidents and near-accidents were occurring and there seemed to be no explanation. The pilots knew they had ice on the airplanes, so they had been using normal landing procedures, but flying the final approach at approximately 15 to 20 knots above normal speed. Yet, lo and behold, the airplanes were stalling at an average of 25 to 30 knots above the computed landing speeds for configuration and weight. Naturally, there were some "shook" airplane drivers around, so they decided to figure the problem out scientifically. A series of tests were set up to investigate:

- Stalls with ice accumulated at cruising speed.
- Stalls with ice accumulated at pattern airspeed in landing configuration.
- Stalls with ice formed immediately ahead of the static source vent.

The tests showed that ice formed at pattern airspeed was deposited on the underside of the wing as well as on the leading edge. This produced greater drag. However, the stall characteristics did not differ appreciably from those with ice formed at cruising speed.

It was concluded that the amount of ice on the wings, and not the type of ice, is the major stall factor.

Evaluation of all stalls with varying amounts of ice produced the following average increases in indicated stalling speeds:

- Trace to ¼ inch—Negligible
- One-half inch—Four knots
- One to 1½ inch—Eight to 10
- Two inches—12 knots

The maximum amount of ice noted on the airplanes was three inches. No stalls were conducted with that ice load. However, in each instance the landing was uneventful since recommended landing procedures were used.

Stalls conducted with ice immediately ahead of the static ports produced indicated stalling airspeeds 17 to 22 knots above normal. The indication that this condition existed was an abnormally high indicated airspeed for the power being used. Another important fact learned in the tests was that if rime ice accumulates on the leading edge of the wings, it is safe to assume that ice has formed ahead of the static ports.

The most critical effect of ice accretion occurred during maneuvering flight at low airspeeds. Any rapid attempt to arrest a normal rate of descent (1500 fpm) caused an accelerated stall from which several hundred feed were required to recover. Moderate ice accretion (one to two inches) presented no serious obstacles when recommended procedures were followed. The following recommendations came out of the tests:

- Avoid icing levels as much as possible.
- If rime ice is present, a power pattern rather than an airspeed pattern should be flown. This type of ice frequently forms ahead of the static source vents causing a low pressure area over the vent holes. Therefore, expect the indicated airspeed to be abnormally high for the power used. A rate of descent of 750 fpm with full flaps, landing gear extended, and speed brakes out should require a minimum of 78-80 per cent rpm to maintain 150 knots regardless of indicated airspeed.
- If there is any structural ice present while preparing to land, place the base leg at a sufficient distance from the runway to maintain a rate of descent not exceeding 750 fpm.
- Arrestment of the rate of descent must be gradual with slight reduction of power, and elevator action kept to a minimum. A properly planned approach at 150 knots should place the aircraft over the overrun or runway at an altitude of approximately 10 feet and an airspeed of 140 knots.

  At 200-300 feet from the runway threshold, power should be reduced gradually and the aircraft allowed to settle to the runway as a landing attitude is smoothly established. It is essential that full flaps be used in order to keep the angle of attack at a minimum.
- Pilots should accomplish several of these approaches under no-ice conditions in order to make adjustment for difference in individual pattern and approach technique.

Missed approaches or go-arounds can be made in a normal manner. The pilot must maintain adequate airspeed for the ice load and avoid high angles of bank. Obviously, if de-icing equipment is installed and operational, it should be used.

The best solution to the ice-wagon type landing is to make a GCA, using power and a controlled rate of descent to get the airplane on the ground. And don't let an erroneous airspeed reading catch you short—of the runway, that is. ▲

Weatherwise, young Mal takes off
At forecasters he's prone to scoff.

En route he trusts his own bright eye
The rough and ragged clouds to spy.

Despite the Skies, tho' dark and grim
Flying 'em all's the same to him.

Forgetful of the helps that be
Wrapped up in numbers one and three.

Too bad he knew not that these blokes
Could've helped him miss the lightning strokes.

*U.S. GOVERNMENT PRINTING OFFICE 441788

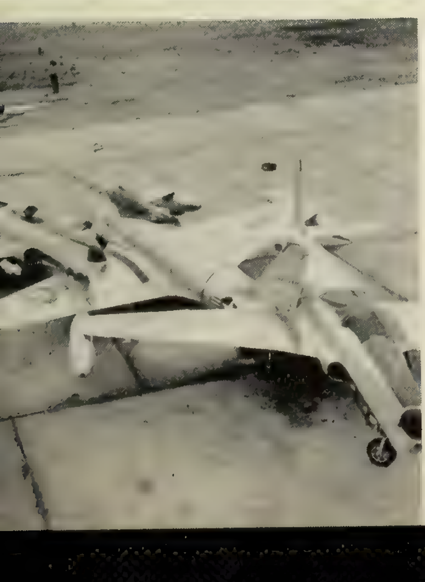
·1305
YS

NOVEMBER 1957

FLYING SAFETY

UNITED STATES AIR FORCE

THE MOST PROBABLE CAUSE...



THE LIBRARY OF THE
DEC [illegible] 1957
UNIVERSITY OF ILLINOIS

Lieutenant General Elmer J. Rogers
The Inspector General USAF
Department of the Air Force

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Major General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Lieutenant Colonel Ralph R. Springer
Chief, Editorial Branch

•

Editor
Major Vernon R. Stutts

Assistant Editor
Major Francis D. Hessey

Managing Editor
William Johnston

Art Editor
M/Sgt Steven A. Hotch

Production
Major Ben H. Newby

Editorial Assistant
Amelia Askew

Distribution
WO Robert Blum

•

Volume Thirteen
Number Eleven

•

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished. Use of funds for printing this publication has been approved by the Secretary of the Air Force and the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the Flying Safety Magazine. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, Flying Safety Magazine, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use of material. Such action will insure complete accuracy of material, amended in light of most recent developments. The contents of this magazine are informational and should not be construed as regulations, technical orders or directives unless so stated.

The Editor's View

Flipping back through the pages of history, one cannot escape the fact that time after time, battles were won and lost by reason of knowledge. The memoirs of some of our most illustrious leaders during World War II point out that due to our lack of knowledge (military intelligence), much of our early effort in the war was unsuccessful.

Even worse than not having the information we needed, we often did not use what we had. The picture was painted, but nobody looked. Or if they did see it, it was with vision blurred by lack of experience in interpretation. Why bother with the past? To learn the truth—so that we can appreciate today and—by understanding what we have learned—live in tomorrow.

Probably one of the most valuable lessons that can be learned is to make the most of every piece of equipment and every bit of information that will aid us in maintaining and improving our combat potential. Most of us will readily admit that, as of now, we do not.

World War II took a little longer than it might have because intelligence that was available, was not used. Aircraft accidents happen almost every day for the same reason. For example, there is an ominous parade of aircraft accident reports which proclaim the fact that pilots fail to use more than one navigational aid when others are simultaneously available. And the failure to know and the failure to act, especially when combined, create a staggering obstacle when the chips really go down. Such is too often the problem in those instances which are cryptically referred to as a "case of an overwhelmed pilot." There is no denying that pilots can reach that state, especially with equipment such as is coming off the assembly lines of today. This was recognized some years ago by the designers of one of our larger machines, and the thought disturbed them. They said that the pilot of their aircraft should have at least the training required for degrees in aerodynamics, electrical engineering and propulsion, combined. While the security of our nation demands that we equip ourselves with this sort of vehicle, definite compromises must sometimes be made as to ideally qualified operators. On the other hand, if we continue to live and operate this highly complex equipment successfully, we are forced to obtain the knowledge which we lacked at the beginning.

The point being that knowledge of equipment, facilities and objectives, while not a substitute in itself, can go far in the way of giving basis for experience and background for judgment. A combination of the three will all but eliminate the ogre of "the overwhelming situation" and "the most probable cause." The only factor remaining is that of physical limitation and this is the area for the designer. He must design within this boundary. We have to learn to live and operate within the very edge to which he is forced to design.

CONTENTS

Lost Horizons 2
Getting to Know You 5
Tips for Tigers 6
Is This Where I Came In? 8
Three Strikes . . . Out 11

USAF PERIODICAL 62-1.

CROSS FEED

LETTERS TO THE EDITOR

May I Ride . . .

The Strategic Intelligence School trains Attaches for duty with American Embassies abroad, for the Army and Air Force. It is an Army school with Air Force participation.

We would like to reprint your article entitled "May I Ride With You?" carried in the July, 1954, and August, 1957, issues of FLYING SAFETY.

Col. Kenneth W. Holbert, USAF
Chief, Attache and Staff Tng Dept
Strategic Intelligence School
Washington, D. C.

Be our guests. This story is one of lasting interest and wide popularity. There is even a Chinese version now.

★ ★ ★

Major Rex Riley

Our attention has been called to an article published some time ago in the Popular Science Monthly on your Cartoon Strip "Major Rex Riley" and the help it has brought to the Air Force.

Our company is engaged in the preparation of training aids, pilot's handbooks and other training materials for some of the major aircraft manufacturers. We would greatly appreciate receiving some back issues of this "strip," since we feel it would help to stimulate ideas as well as serve as an accurate reference file.

Corydon M. Johnson Co. Inc.
Bethpage, L. I. New York
By: Richard W. Snow

Much obliged for wanting to help! We can't overdo it.

★ ★ ★

Pile of Sawdust

I read your magazines every time I see one and think that they are the best magazines on safety printed in the Air Force. I have an idea that will save many lives. This is it. Place a large pile of sawdust in the middle of every Air Field and when the pilots get into trouble they can climb out on the wing and jump off into the sawdust, thus saving life and limb if not the machine itself. Sawdust is cheap and may be had for the asking at any hobby shop or from many pilots' heads. If this idea is worth anything to you you may send the check to this address.

John N. Dreary
2130 "O" St. N.W.
Washington, D. C.

Maybe you've got something there! Any takers? Glad to find a market for this stuff between the ears.

Crash Landings

Several months ago you published an article concerning suggested methods of making crash landings. Operations personnel of the Brazilian Air Force have expressed a desire to read and translate this article, but a copy cannot be located in our files. If you have one available, could you please forward it to this headquarters so it can be passed to the personnel of the Brazilian AF?

U. S. Air Force Section
Joint Brazil-U. S. Military Commission
Det 20, 5500th Foreign Mission Sq.

Thanks for your interest. Check September issue, page 26, for more of same.

★ ★ ★

A Fresh Look at an Old Problem

I've read with interest your brief report on the T-Bird accident, attributed to ice in the low pressure fuel filter.

The appalling thing about the whole affair is the ignorance of the pilots of this hazard. This situation should be emphasized in all T-Bird indoctrination programs. Many T-33s based in the South never carry alcohol. Many bases throughout the U. S. do not have a supply of alcohol. A pilot cannot comply with procedures outlined in the Dash-One unless he is furnished the essential materials.

Capt. John D. Riley
Hq Iceland Defense Force

How about it, supervisors?

★ ★ ★

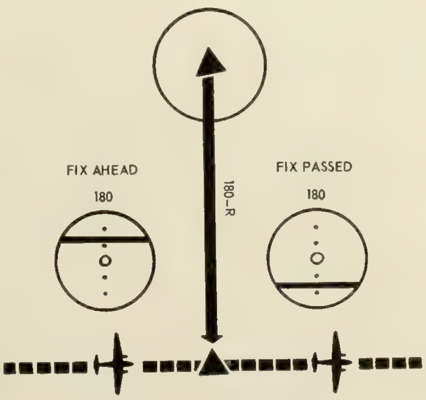
VOR Intersection

Ever notice any confusion in the cockpit when working a VOR intersection? Try this: Always set the radial that defines the intersection into the course selector window. Now, if the needle is deflected to the same side as the off-course station that forms the fix, your interesection is still ahead. If, after tuning the station, you find the course indicator needle off center to the opposite side you have passed the intersection.

Standardization on this procedure makes it easy to visualize your position in relation to the fix, particularly if the ID 250 (RMI) is on the blink.

1st Lt Jack Searle
3550th CCTS, Moody AFB.

Thanks, Lieutenant. Most helpful!



File Thirteen

A pilot of an F-102 aircraft climbed through 36,000 feet with afterburner, made a slow turn and a supersonic dive to earth. Most probable cause—Hypoxia. . . . No evidence that accidents from this cause are decreasing. One command alone logged 43 reports of hypoxia during the first six months of 1957. Walk-around checks should include inspection of liquid oxygen filler valve to assure that it is in the *buildup* position. . . . Pilot dies of heart attack while flying a T-33. Most probable cause: Nitrogen bubbles entering bloodstream from fatty tissues around heart when subjected to high altitudes. See FLYING SAFETY, April 1956. Weight can be deadly. . . . A new procedure for the control of air traffic above 24,000 feet MSL has been published in the Radio Fac Chart. This means a big change is coming up. Earlier message stated "on or about 1 November" but kickoff date has been set back to 1 December. . . . Topside is concerned about increasing mid-air collision hazard due to jet aircraft descending on airways in excess of recommended IFR penetration speeds or excess rate for the particular aircraft. Slow it down and clear below before you go. . . . Despite the fact that we've had ten less mid-air collisions this year than at the same date last year, the picture is still on the grim side. . . . Accent is more than ever on the ability of pilots to meet full qualifications for their specialty all the time. . . . Recent emphasis by word from The Pentagon to Flying Evaluation Boards, through commanders, is: "Get Tough." . . . One night flight every four months won't hack it. . . Budget battle has delayed publication and distribution —or had you guessed? . . . Hear about the C-121 pilot who was unable to effect prop reversal due to "foreign objects" on the throttle quadrant? Major damage when he ran off the runway. Murphy Junior's law says, "If it can get in the way, it will." Keep it clean. . . .

'til December,

Vernon R Stutts

LOST HORIZONS

Col. H. G. Moseley, Chief, Aero Medical Safety Division, Directorate of Flight Safety Research.

RECENTLY AN ELEMENT of two fighter aircraft was making an instrument approach to a strange airfield. It was night and very dark. The element leader let down to 3500 feet and was in a 30-degree bank onto final approach when he suddenly became quite confused as to his direction. He immediately brought his aircraft back to level flight, regained his sense of direction and again kicked into the 30-degree bank to complete the turn onto final. At this point he was surprised to find his cockpit illuminated by a bright flash of light behind and below him.

That flash was caused by the wingman's aircraft when it struck the ground and exploded. Result—scratch one wingman.

No one ever knew exactly what happened, and lacking final proof, it might eventually have been relegated to the limbo of "Cause Undetermined Accidents." The evidence in this case, however, pointed straight to one of the most vicious killers that is free in the skies today.

This enemy—this annihilator of pilots and crews—is all the more dangerous because of the pseudonyms and aliases by which it is identified. Generally, it is termed as *Vertigo*. It is also called "Spatial Disorientation" and sometimes identified as "The Leans." Some survivors have simply stated that they were attacked by "Monumental Confusion." But no matter what you term it—and for simplicity we will call it Vertigo—it is a good thing to become acquainted with. And if you are a pilot, you'd better know all about it; know what it is like, what brings it on and how to avoid it. This is fundamental if you want to survive.

To understand Vertigo, one must understand a little about three of man's special senses: sense of vision, of pressure and equilibrium. The latter two demand most of our attention because it is upon them that vertigo preys. These senses of pressure and equilibrium are quite remarkable. Without them we would be completely helpless as soon as darkness sets in. If we did not have these phenomena which give us information about our position and direction, we could only move about in daylight. As it is, however, we can walk in complete darkness or even bend or turn and progress to distant points in an upright and balanced position.

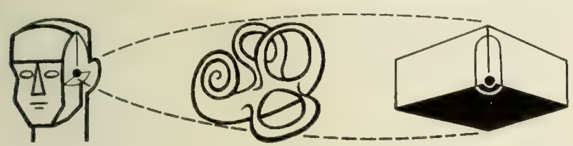
The sense of pressure lies within our muscles, skin and to some extent within our joints, and tells us the direction of the force of gravity. In other words when we stand, the pressure we feel on the soles of our feet and within our legs tells us that our feet are on firm ground and that we are standing upright. And no matter what position we are in, these pressure senses tell us the direction of up and down. In some diseases where these senses of pressure are destroyed, the individual has to be led by hand when it is dark, otherwise he would stumble, fall and be unable to right himself again.

Our sense of equilibrium is even more remarkable. It is governed by what is called our vestibular apparatus. These are small special organs which are constructed a good deal like a set of gyros and are set within our skulls, one within the bones by either ear. (Fig. 1.) These human gyros are filled with fluid. When we turn, the fluid lags a bit like water in a wine glass when you twirl the stem. We are able to feel this lag and it tells us we are turning. Similarly when we stop turning, the fluid which by now has started to move continues to flow for a moment. This is quite important because as you turn rapidly the flow in the vestibular gyros gets to moving rapidly too; and when you stop suddenly this continued flow of fluid makes you feel strange. It may make you dizzy, and it may make it very difficult to walk straight. Every child who has wound himself up in a swing, unwound rapidly and then tried to walk, can tell you about these sensations. Such dizziness caused by the too rapid movement of fluid in our vestibular gyros is a tremendous factor in the cause of vertigo.

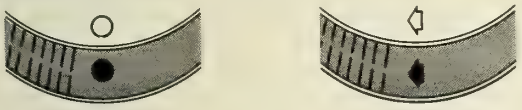
This would be of interest but of no great importance if we remained on the ground. Very few pedestrians or sleep walkers get into trouble because of their senses of equilibrium. In flying, however, the senses of pressure and equilibrium are subjected to strange and unusual compromises. They can become so misled and so confused that they give the pilot completely erroneous information concerning his direction or orientation. Hence, the term *disorientation.*

Consider first of all the simple sense of pressure which we feel with our skin, muscles and joints, and which tells us which end is up. These senses simply measure gravity and as gravity pushes down, where we feel the most pressure must be straight down. However, almost the only type of gravity which man has known from time immemorial has been the gravitational pull of the earth, and therefore man has been conditioned to believe that the greatest gravitational pull must be straight down toward the center of the earth.

But in flying, one continually changes the direction of gravity. If we turn the aircraft and hold it in a turn the greatest degree of gravity is directed toward the periphery of the circular plane we are establishing, and here is where our senses of pressure get confused. To these senses, the greatest pressure we feel should be straight down, not sideways, and our brain receives a continuing series of messages telling us we are sitting straight up and down, exactly like we would be in a chair within our home. If we close our eyes while in such a turn, or if it is dark or cloudy, we can not help but believe these messages, and when we open them again and

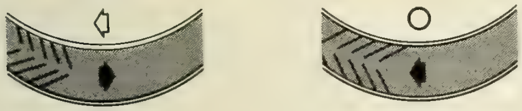


The inner ear is located in the head approximately as shown and is about the size of the black dot.
Each canal and the common sac is completely filled with fluid. Into the ends of each canal, project small sensory hairs which are deflected by any movement of the fluid in the canal, and which are responsible for the sensation of turning in any of the three planes or vectors thereof.
As the head is rotated, the canal in that plane of rotation will move with respect to the fluid in it. Since this fluid has inertia, the resulting deflection of the sensory hairs will cause a sensation of turning.
Enlarged, the actual structure is similar to drawing. The semicircular canals are circular tubes lying at right angles to each other in the planes shown.
The static organ is located in the bottom part of the common sac, and consists of delicate sensory hairs projecting upward, on which rest small crystals.
The load borne by these sensory hairs changes in the head with every change of the head with respect to gravity, and this creates the sensation of tilting the head or body.



No rotation.

No sensation, no deflection.



Sensation of turning to brain. Rotation of canal deflects hairs.

Sensation of turn in opposite direction. Rotation stopped deflects hairs in opposite direction.

Sensation of movement to brain.

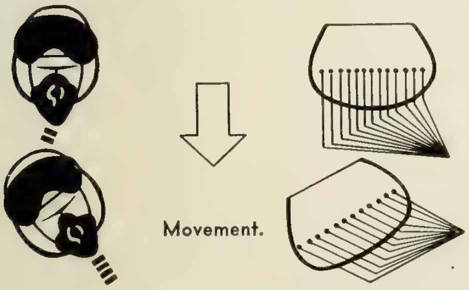


FIGURE ONE

see that we are really in a 90-degree bank, it is difficult to believe our eyes.

In fact, there was one accident not long ago where two pilots flying jet fighters at 30,000 feet at night became separated in a cloud. When they emerged, one pilot noticed the other aircraft upside down above him. It was only subsequent to the accident when he compared notes with this other pilot that he finally realized that it was he himself who had been upside down. This all happened because he inadvertently rolled through the cloud and heeded only the gravitational pressure that continued to press on the seat of his pants. He admitted that his instruments were acting strangely.

However, it is the vestibular gyros which can confuse us most of all. When we turn or roll or whirl or otherwise agitate the fluid in these gyros, the messages our brain receives become most garbled. And hence the rest of the story of the upside down pilot we just mentioned. When he fell out of his unnatural position, he was thrown into a spin, and although he brought the aircraft out of the spin on several occasions, he immediately went into another spin. Finally noticing the altimeter unwinding at an alarming rate, he decided, with considerable justification, to leave his topsy-turvy aircraft which appeared to be bent on his destruction.

But, it was not the aircraft which was trying to destroy him. In fact, the aircraft was functioning properly and only responding to the unreasonable kicks and thrusts he was delivering to the stick and rudder. What was bent upon his destruction was our old acquaintance Vertigo. In this case the pilot first became confused through his sense of pressure, but then when the fluid in his vestibular gyros began to whirl he was thrown into a series of overpowering and false sensations. When he would come out of a spin his organs of equilibrium would tell him that he was still spinning but in the other direction, and in trying to correct for this, he would spin again, and so on ad infinitum. He was truly a victim of "monumental confusion."

However, one does not have to spin an airplane to get vertigo. Even turns, dives and climbs, if they are sharp enough or prolonged enough, can stimulate our sense of equilibrium to a degree where we may become confused. And here lies another consideration of utmost importance. Our vestibular gyros are not simple little organs. On the contrary, they are remarkably well constructed and are able to pick up several different sensations. For example, they sense turns to the right or left, feel movements of up or down or back and forth, and even respond to the sensation of dropping. In other words, they tell us whether we are turning, twirling, somersaulting, slithering or falling. It is quite possible to stimulate several of these varying planes of our vestibular apparatus at the same time. And this can lead to rather tragic results.

About a year and a half ago, FLYING SAFETY published an article concerning pilots who dove their fighter or interceptor aircraft into the ground immediately after attempting to change UHF radio channels. In this maneuver, they had to turn their heads to the right and look down toward the rear of the right console. If their aircraft was also in a bank when they turned their heads so sharply, they started the fluid moving in several planes of their vestibular apparatus. Then when they looked forward again their senses were so severely compromised that they were actually incapacitated for a few seconds. If you do not believe this is possible, just sit on a piano stool, turn your head sharply to one side or simply tilt it back about 60 degrees, then have a friend twirl the stool around about five times in ten seconds while your head is still sideways or backwards. After the fifth turn, stop suddenly and bring your head sharply forward. Many people who have tried this have actually and involuntarily thrown themselves sideward off of the stool. If you were trying to fly an aircraft at this time, you would find yourself completely incapacitated.

Having the head turned or tilted forward or back while the aircraft is in a sharp bank is probably one of the worst situations a flyer can put himself into. This indicates that it is quite important to keep your head straight and level while you are in a sharp turn, otherwise you will start so many of your vestibular gyros twirling that confusion is almost inevitable.

However, all pilots who fly will encounter various sensations which arise from the unusual stresses and strains which flying puts upon their senses of pressure and equilibrium. Major General Harry G. Armstrong, in his book "Principles and Practices of Aviation Medicine" describes the following false sensations of flight. They are of tremendous importance.

- *Unperceived Motion.* The organs of equilibrium are fairly insensitive to gradual changes of direction, so that in blind flight there may be motions of the airplane which are not sensed. The average person can be tilted about 10.6 degrees downward or 24 degrees upward without being aware of any change. Also, the body must be rotated with an acceleration of more than about two degrees per second before such motion is sensed. As a consequence in blind flight the airplane might dive or climb at a fairly steep angle and bank or turn at a fairly high rate without there being any sensation of any change from straight and level flight.

- *Sensation of Climbing While Turning.* In a fairly sharp horizontal turn the banking of the airplane is not usually sensed, but there is an awareness of the body being pressed more firmly into the seat as a result of the centrifugal force. As a consequence, the sensation is that of a zoom upward, and is interpreted as such, and the natural reaction is to push forward on the stick.

- *Sensation of Diving During Recovery from a Turn.* During recovery from a turn, the pressure of the body on the seat is decreased which results in a sensation similar to that when the airplane is nosed over from level flight into a dive. As a consequence, in blind flight return to level flight creates the false sensation of diving, causing a tendency to pull back on the control column and resulting in a steep climb and possible stall.

- *Estimating the Degree of Bank.* Because the amount and rate of bank of an airplane, in going into a turn, is below the threshold of the organs of equilibrium, the degree of bank attained during blind flying is usually underestimated. This causes the pilot to bank too steeply in going into a turn, and to overcorrect in a return to level flight which results in a bank in the opposite direction.

- *Unperceived Banks.* Under ordinary circumstances, if one tilts the body sideways, this can be easily sensed since the pull of gravity on the body makes us aware of this tilt. In an aircraft turn such a sensation of tilting does not exist because the body is acted upon not only by gravity but by centrifugal force and the resultant of these two forces acts in a line perpendicular, not to the earth, but to the transverse axis of the airplane which creates a sensation of sitting erect.

- *Sensation of Opposite Tilt in a Skid.* If an airplane skids during a turn, the centrifugal force on the body no longer acts perpendicular to the transverse axis of the airplane, and there is a sensation that the airplane is banked in the opposite direction from its true position.

- *Optical Illusions from Clouds.* When flying between cloud layers which are not exactly horizontal, the clouds are used as a horizon and the airplane is flown at a corresponding tilt away from its true level attitude.

- *Sensation of Diving Beyond the Vertical.* If in a very sharp turn or in a spin, the head is suddenly turned downward, as might occur from looking at an object on the floor of the cockpit, the vestibular apparatus of the inner ear is acted upon by two distinct rotary motions at the same time, with the result that there is a sensation of falling forward. Thus, the airplane feels as though it had suddenly nosed downward beyond the vertical, and the natural response of the pilot is to pull back on the control column which, in a spin, only aggravates the situation.

This type of motion, i.e., when an active movement of the head is made in a plane at right angles to a plane of passive rotation, is known as Coriolis acceleration. This may take place, for example, during a spin if the pilot should meanwhile move his head up or down. If the head is moved (turned) downward during a left hand spin, the resultant sensation is of rotation to the left and downward and the falling reaction is to the right and downward. When present, the Coriolis reaction usually produces marked vertigo and is especially dangerous in aviation for that reason.

- *Sensation of Reversal of Rotation.* If, in blind flight, any rotary motion persists for a short time and is then either retarded or stopped, the fluid in the affected semicircular canal continues to rotate and creates a sensation of rotation in the opposite direction. Thus, after a recovery from a spin to the left, there is then a sensation of turning to the right, which the pilot attempts to correct and thereby causes the airplane to spin again to the left.

In view of such compromises, one might well ask, "What can a poor pilot do?" Fortunately, Vertigo—though a ruthless deceiver—can be shaken off when it first attacks, providing you muster enough resolve to ignore its false messages. And this means believing your instruments more than you believe your senses.

To quote again from General Armstrong, "Most of the time spent in learning instrument flying is nothing more or less than learning to ignore the false sensations from the organs of equilibrium. No one ever learns instrument flying who has not been thoroughly convinced that the sensations are always wrong whenever they disagree with the instruments."

However, when Vertigo strikes hard it may be almost impossible to ignore the confusing messages that our brain is receiving. Thus, it is best to avoid Vertigo insofar as possible. Here are a few simple points that will give you reasonable immunity:

- Always remember that your instruments are more reliable than your sensations.

- Know the false sensations of flight and be ready to identify them.

- Instrument flight is one condition where it pays to have your head "up and locked." The more you look around the more likely you are to tumble your vestibular gyros.

- Remember that your wingman has only you to guide him. If you lose him in the soup, Vertigo will try to take your place.

- Lastly, and most important of all, keep ahead of your instruments. If you can eliminate surprise, you can pretty well eliminate attack. However, once you lose your horizons, be they real or artificial, you are in for a running battle with a most treacherous adversary. And this is one battle you cannot afford to lose. ▲

Getting to Know You

Bob Hoover, Test Pilot, North American Aviation, Inc.

EVERY FIGHTER PILOT enjoys lazily rolling an airplane or buzzing close to a cumulus buildup. At least, if he doesn't, he should. This desire should be an inherent part of his eagerness to fly. We all know, however, that aerobatics serve more purposes than the mere satisfaction of a whim.

One of the quickest ways for a fighter pilot to become familiar with, and feel at home in, his airplane is to practice aerobatics for a few hours. There is no greater confidence builder. A good tactical pilot will always be a better one if he is not dismayed by some unusual attitude.

A pilot learns the basic fundamentals of aerobatics in flying school. From that time until he hangs up his oxygen mask or retires from fighter flying, his schooling continues as each new fighter comes along.

An old timer once said that if a fighter pilot can survive the first visit to his home town and overcome the natural urge to beat up the neighborhood, he might live to a ripe old age. Even so, it never ceases to amaze us when we hear of a good fighter pilot getting clobbered because he rolled too close to the ground or didn't have quite enough altitude for recovery from some low-altitude maneuver.

With the exception of the LABS maneuver (and well-planned flight demonstrations with a purpose, such as demonstrating the over-all airplane capabilities), nothing is gained by doing aerobatics near the ground. Very few pilots have gotten away with low-altitude aerobatics without a world of practice beforehand—at altitude. Some excellent pilots have bought the farm trying to duplicate a maneuver which they saw another pilot perform at low altitude. They overlooked one important factor. The pilot who performed the maneuver successfully must have put a lot of thought and a great deal of practice into his aerobatics.

Split "S" maneuvers and steep dive angles have killed many first-class pilots who did not project their thinking ahead of the airplane. I've heard pilots boast of split "S"-ing a given type of airplane from a particularly low altitude. An inexperienced pilot hearing this comment may attempt the same maneuver without consideration for an entry airspeed or the G required on recovery which is an all-important factor. With a lot of practice and entry at a very low airspeed, as well as a complete knowledge of the airplane handling qualities, a pilot may be able to perform a split "S" at very low altitudes in most airplanes. But what is the advantage?

A few years back when the F-86s were new in the Air Force, a pilot about to check out in the airplane asked what altitude he should try loops for the first time. An old head spoke up to recommend 25,000 feet. Here was an experienced pilot who must never have attempted a loop at this altitude. Otherwise he would not have made this recommendation.

Why was he wrong? The greater the altitude, the less G we can pull. This is because G is a function of the density of the air, which decreases with altitude.

As a result of this phenomenon, many pilots have inadvertently whipstalled or hammer-headed into a spin while attempting a loop. After recovery, they wondered how this could happen with so much airspeed upon entry. The point to remember is this: You can get into trouble by attempting aerobatics too high just the same as you can when you are too low.

In each new and faster airplane, there is a question of the usefulness of aerobatics in individual combat or dog-fighting. At the outbreak of World War II, many pilots with limited experience thought that dogfighting had died with the close of World War I. Yet, a lot of airplanes were shot down in World War II during a good old all-out dogfight.

Once more, when the F-86s were scheduled for Korea, people said that the closing rate would be so great with this airplane that individual fighting would be very unlikely. Yet, this air war produced an impressive 14 to 1 kill ratio in favor of the F-86 team over the MIG in fighter-to-fighter combat. However, with a large increment of speed increase over a previous model airplane, we do find ourselves with less time on the target and with a shorter period of contact with the opponent.

When the F-100 was first flown, many pilots felt that aerobatic maneuvers would be difficult to execute because of its supersonic speed and tremendous rate of climb. By now, most people with an interest in the flying world are aware of the excellent aerobatic show being performed daily in the F-100 by the famous Thunderbird Team. This show is one of the most impressive flight demonstrations I've ever seen.

***But we all must** remember that proficiency in aerobatics requires an awareness of our own limitations as well as those of the airplane. Above all, it requires the use of common sense. Don't try forbidden or restricted maneuvers. And don't attempt aerobatics in your airplane without knowing the limit load factors.*

Each and every airplane, whether fighter, bomber or trainer, has been designed to a specific set of limit load factors. The limit could be 3G, as for some bomber designs, or 7.33G, which has been considered the limit on most fighters. These limit load factors are for straight or symmetrical pullups. If G is applied in a rolling turn, the load factor limits in order to realize its potential for the design mission.

Sure, aerobatics are good. But, when you perform aerobatics in your airplane, remember this: You must

- *Know your airplane.*
- *Know its limitations.*
- *Know your own limits.* ▲

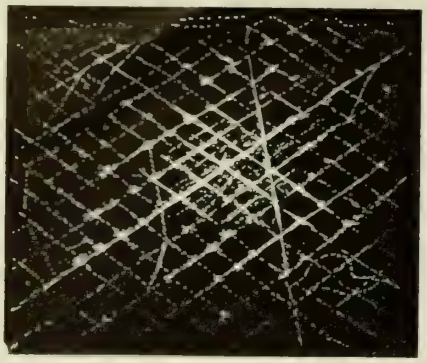
TIPS FOR TIGERS

(or)

CARELESSNESS CAN BE COSTLY

This was only a short trip. Yet this '86 driver admits that he made six mistakes. Flying Safety Magazine *is grateful to him for this contribution. It may help other pilots.*

• • •



• • •

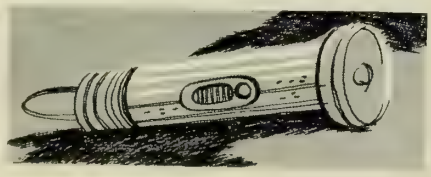
ANOTHER SENIOR PILOT and I had attended a meeting at Hamilton Air Force Base, up near 'Frisco. He was from Phoenix and my home base is Tucson. We were both driving F-86s, and on our return trip we landed at George for fuel. Since he was going to Phoenix, and I to Tucson, we filed separately but briefed to get some night formation, with me on his wing until we reached Blythe. Then I would dog leg to Tucson, and he would go on to Phoenix.

Our birds were clean, and we estimated takeoff at 1805, just at dusk. The engines were started and we taxied out, but were delayed for about ten minutes for some landing F-102s.

Takeoff and climb were routine except that I didn't remember the exact time of takeoff, after our delay. (Mistake Number One.)

I had some trouble maintaining close formation but kept the lead ship in sight even though the lights on the ground and the bright stars did force strict attention.

I didn't tune in my bird dog because I had confidence in the lead pilot and I intended to head for Tucson when he made a position report over Blythe. I never heard this position report so I concentrated on flying formation. I called him once for a reduction in power and immediately caught up. However, he never received this call because his radio had gone out. It was just a coincidence that he reduced power. He also could not make the position report which was my cue to head for Tucson. I followed faithfully. (Mistake Number Two.)



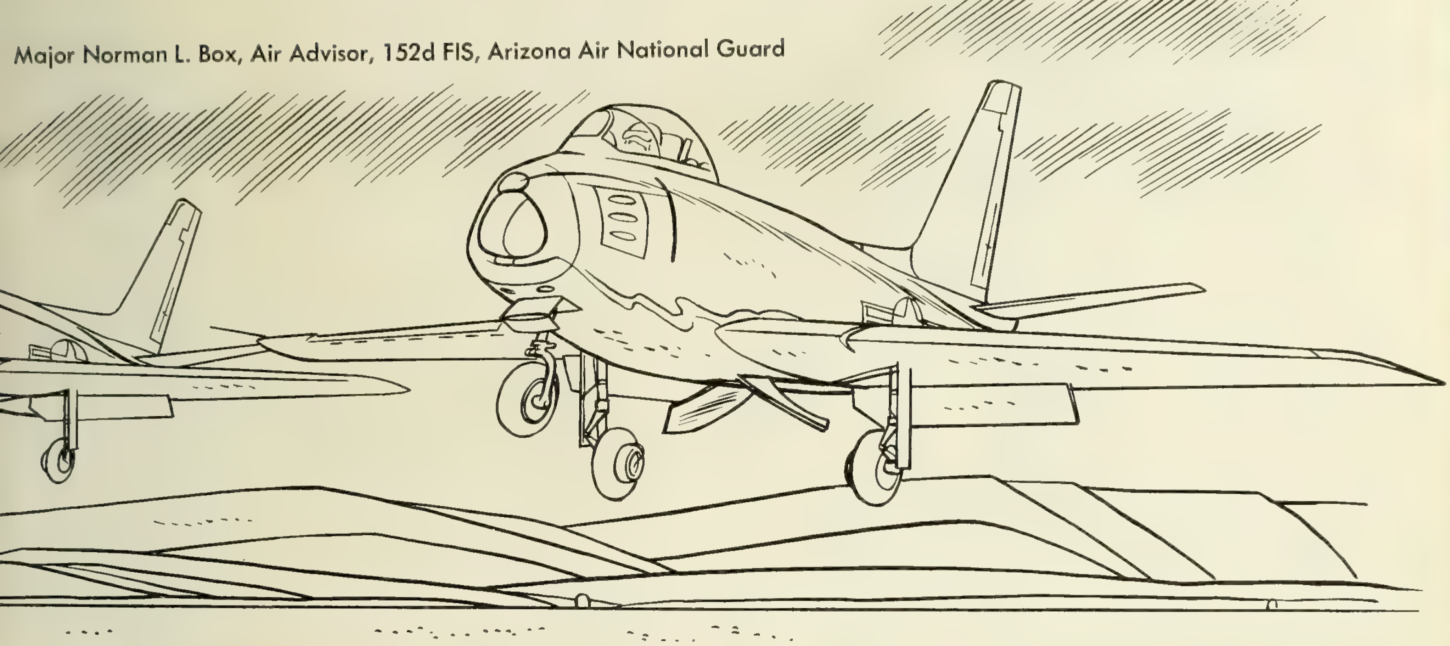
The lead was proud of me, thinking that I knew his radio was inoperative and would go via Phoenix and call for him to inform the tower of his muteness.

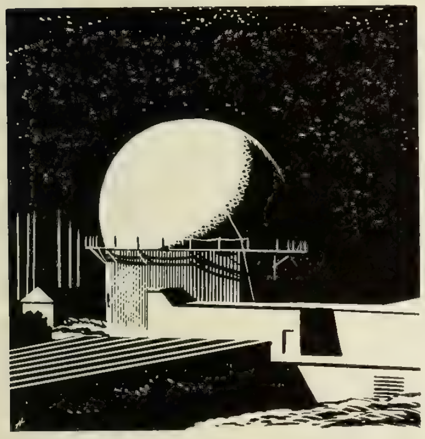
I paid very little attention to the ground and as I saw city lights approach, thinking it was Blythe, I began my dogleg toward Tucson. (Mistake Number Three.) Instead of Blythe, we were approaching Phoenix. Had I looked, I certainly would have known by size alone. I turned on my bird dog to Tucson and had some trouble seeing the dial. My flashlight, which I had checked the day before, was dead. (Mistake Number Four.) I identified the station. It was about 20 degrees to my right and unstable which was correct for about 135 nautical miles off. I checked the time. For the next ten minutes I admired the darkness and clearness of the Arizona nonrestricted sky at 38,000 feet msl. (Mistake Number Five.) Since I should have seen the gay lights by now but didn't, I retuned my bird dog. It came in clear, and the needle steadied about 120 degrees to my right. I didn't believe it. (Mistake Number Six.) I switched channels and called the nearby radar site to say that I was in the Gila Bend area and wanted a steer to Tucson.

I maintained my heading, squawked and re-squawked on several different modes, and when positive identification was established, they told me that I was 110 nautical miles northeast of Tucson. My fuel showed 85 gallons. I was given information on distance to Winslow. I asked for winds at 38,000, and since they were in my favor toward Tucson with its long runways, I chose Tucson. I wasn't familiar with Winslow anyway. I could hardly believe the headings which they gave me. But I followed their instructions . . . the first correct thing I did!

They kept check on my groundspeed, altitude and fuel. They were worried as to whether or not I'd make it. But they weren't nearly as

Major Norman L. Box, Air Advisor, 152d FIS, Arizona Air National Guard





worried as I was by now. I went through my ejection procedure, which came easy. Dark and alone—80 nautical miles to go, with 60 gallons of JP-4 to go on. It looked real bad. I tried to wean the J-47. I thought of stop cocking, riding the wind and then restart for landing, but the darkness changed my mind.

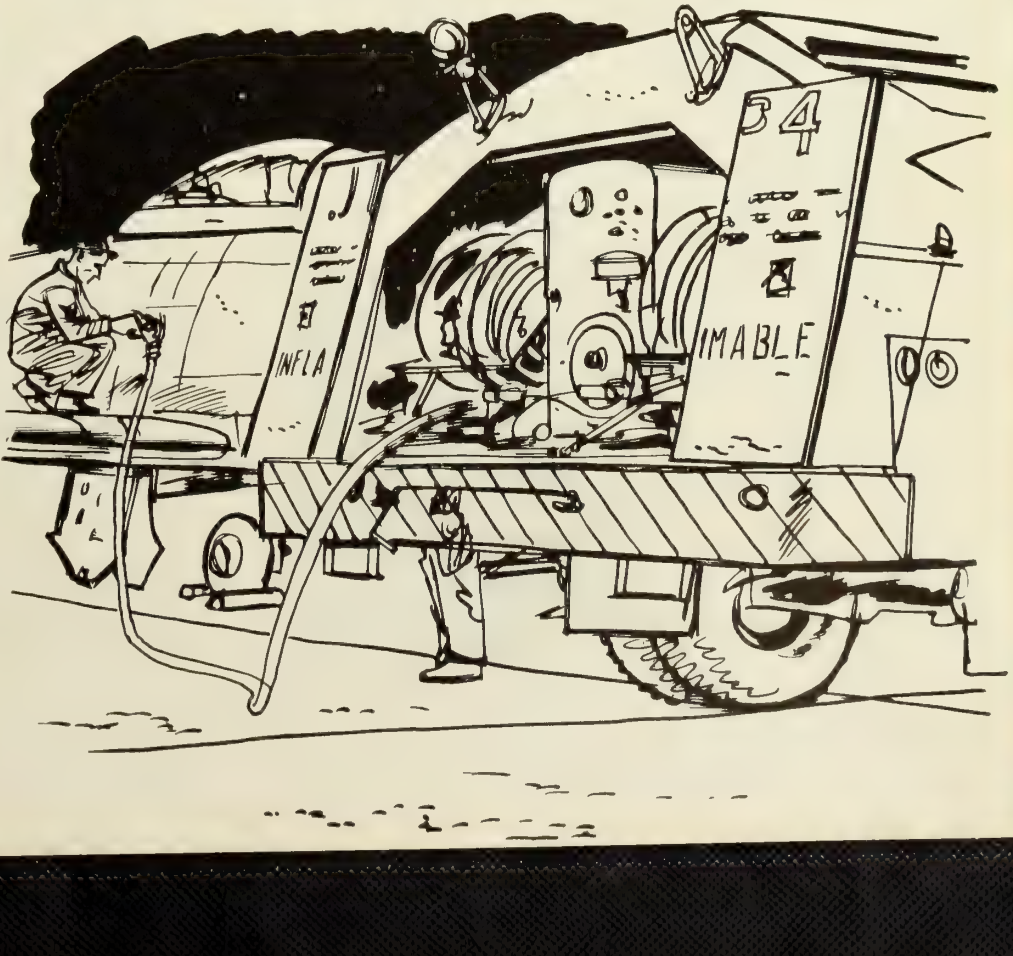
As I could see the distant lights of home, my fuel gage was nearing the peg. I was at idle and descending. I declared an emergency with the tower which gave me a choice of either direction on the long runway. I knew that I had the field made, but in what direction, I wasn't sure.

The empty peg was supporting the fuel gage needle. I was high and had to open speed boards—not recommended below 50 gallons. When they opened, the fuel needle flicked. I thought I had flamed out, however I still had power. A 90-degree turn was made on final and good old terra firma was felt and the landing was completed.

I taxied in and parked. Was sort of nervous, too. In Ops I was informed that Flight Service had inquired about my being overdue about 25 minutes.

Flight Plan was closed and a "thanks" rendered to the radar site for the "save." And I went home.

In reminiscing, it was easy to see the numerous, so-called "little mistakes" I made that developed like the proverbial snowball into a serious situation. At no time was I lost—I knew I was over Arizona somewhere. When the aircraft was serviced, it took 431 gallons, and holds 435. This is much too close for comfort on a dark night. I do not recommend this type of procedure. Believe me, it's not easy on your constitution. ▲



IS THIS WHERE I CAME IN?

MAJ. WESLEY S. MINK
RESEARCH and ANALYSIS DIV.
D/FSR

SWEETIE AND I got to barbering the other night about who said what to who before we were married and then she got down to cases. Certain promises were made to her, she said. And these promises were made before she agreed, she said, to walk up the aisle. These promises, it suddenly seemed to her, had been forgotten since those glorious years when we were young. Or why was she locked up here in this steaming kitchen all day long? And so on. And so forth. It looked for a while as if I might lose the argument.

Then I remembered some evidence I had tucked away. So I left. While Sweetie went back to the dishes in the kitchen sink, I crept out to the garage. There, piled on top of one another, are various boxes, old trunks and bags with which we pack our stuff and move from station to station in our pursuit of Sweetie's happiness and my career. Underneath everything else is my first battered footlocker, the one in which I used to keep everything in the world that belonged to me—until I got married to Sweetie, that is. And I guess it would still hold everything of mine, except the little woman. And even that might not be such a bad idea sometimes. But that isn't here and it isn't there. The fact is, I was pretty sore. So while Sweetie went on mumbling over the kitchen sink, I tore the bags and boxes down and dragged my footlocker out beneath the one bare bulb in my garage. There I could still read where it said, "2d Lt."—(Oh, those were the good old days!) The lock was rusty now and the hinges squeaked, and a few qualms rose from my half-forgotten youth as I lifted the lid and sniffed the traces of smuggled Chanel and broken fifths, foot powder, chocolate bars and cigarettes. There was a whiff of G.I. mothballs too and the scent of a packet of Sweetie's prewar letters—those famous letters written before we began to fight. It was these that I wanted. If I remembered rightly there were certain notes—Well, Sweetie, herself, had made some promises. If I could find the letters I had in mind, I'd go back in the house again and Sweetie could literally swallow her own words. For all I cared she could choke on one or two of them.

But about that time I came on a couple of opera tickets from Dijon and some Vichy francs, together with certain photographs I should have burned, and a tear-stained letter signed "*Yours*, Christienne." I hasily tucked these indiscreet reminders of the gaiety days into the garbage can. Then I went back to root out the vital evidence. That's when I found four carefully folded sheets of yellowing paper neatly titled, "Flying Safety." I was immediately intrigued.

I forgot for a moment about the letters. I sat down on the concrete floor and began to read.

Flying safety is my business now and, in a way, it always was. Right now I happened to be assigned to the Analysis Branch in the Directorate of Flight Safety Research. But long ago, when these yellowing papers were first written out at my request, I was commanding officer of a fighter training unit in Abilene. That was in 1943. My job was to see that pilots, who were even younger than I, were taught the finer points of the fighter's art. And even in those departed days, flying safety was built right into the regular course.

It was a must in those days when we were turning out pilots almost as fast as they could be taught that casual salute, with which we greeted those senior officers we happened to know and like. We wanted to make our students really aware of the problem itself so I used to demand a paper from each of them on flying safety. This paper I'd found in my footlocker was one of the best. That's why I'd kept it. It was good in 1943. Maybe it is still good today. Maybe, in fact, it's a little too apt to pinch our shoes these days, although a dozen years and more are gone since it was written by an astute and obviously browned-off fighter pilot who had yet to fight, and who wanted to be prepared for the very worst.

So although the honeymoon may be over for Sweetie and me, and although planes may be flying faster and going higher now than they were then, flying safety is here to stay. And some of the things this boy unerringly fingered whilest he was teed off, still in his fledgling days, are still too true for comfort.

"In the past year," he began by noticing, "safety rules and flying regulations have grown tighter and tighter . . . but the many restrictions on flying have not wiped out the tremendous expense, loss and tragedy of numerous accidents."

Well, I had to buy that. And I couldn't quite put the paper down. "Each month's accidents," I read on, "contribute to new flying restrictions and each restriction is now being seen by some to reduce the efficiency of our training program. These gaps left in our training will eventually lead the way to new mishaps. We have the old vicious circle. This gives each accident new meaning. . . ."

It certainly does, I thought, still sitting on the cold, cold floor. And maybe this boy was laying down an argument we don't care to follow now.

Who wants to think that in leaning backwards to keep our student pilots out of trouble, we've simply kept them in? But maybe we have. And maybe it's wrong to try to sanitize the hazardous business flying can be, to make flight deceptively oversafe for student pilots whose basic approach to flight is being formed. Maybe this student of mine was right when he went on to say that since he knew he'd run into trouble when he flew for keeps, he'd just as soon have a chance to do the same sort of hazardous flying now, in training, while he had time to learn.

"The whine of a siren," he went on to say, "brought us out of the barracks one afternoon. We gathered in groups outside the doors and searched the horizon for a cloud of dust or a column of smoke or any other indication of what had happened. From our appearance, we might have been an accident conscious crowd. Not exactly. Our first thoughts should have been with the pilot, the plane and the causes, and so on down the line. But they weren't. We were something different from an accident conscious crowd.

"*We were a record conscious crowd.* 'Another one for the books' we thought. With each mishap we could feel our grip loosen on some of the more unconventional yet more instructive training missions and maneuvers still available to our fighter wing. We could see the colonel pacing the floor, losing a few hairs. We could see tomorrow's poster with our wing's percentage tube towering over the others. We could picture some little quip at the bottom about winning first place again, designed to spank us gently and arouse our fighting spirit. We could see the unscarred hand of the First Air Force reach out and pluck another ribbon from the air. So far so good. Nothing is wrong with competition. It spurs us on.

. . . "Let's walk over and see the Colonel lose a few hairs."

"But here's the trouble in our training program. Everybody, except a few wives and mothers and maybe the chaplain, looks at an accident as just 'another one for the books.' The whole setup is record conscious. They take the accidents and add them up and segregate them and compare them to last month's accidents. They work them over as intelligence men work over an enemy code. Finally, they find an answer, the same old answer, which will cut down on today's mishaps. It comes out in directives of, 'No more this!' and 'No more that!' Very simple. The best way to have a clean slate is not to fly at all.

"But the training eliminated from the course last year is a lost art as far as many of our trainees today are concerned. Because of this, they are not as precise and cannot be as experienced. The step taken last year, designed to cut down accidents, may well have backfired and made for a higher rate today. It may also be breeding future pilots who won't be as well equipped to cope with out of the ordinary situations they're bound to meet in the air. . . ."

Well, this boy was writing about a state of affairs that existed years ago when we were in a hurry to build up for war. In the rush to get ready, perhaps we did make some mistakes. But have things changed as much as we like to think they have? Isn't it possible that we still sometimes take this same negative approach to training? Don't we sometimes punish the pilot who commits an error by withdrawing his right to learn? Isn't that just what you do when you rule out as being unsafe for him now the kind of hazardous flying on which he may one day have to depend for his life? I wasn't so sure as I read on.

"Another aspect of the situation," my onetime student wrote 'way back in 1943, "is the outlook the pilot has

These pictures and cover pictures have one thing in common—airplanes get "broken" just as easy today as they did in the "good ol' days." The reasons for the breakage don't change much from year to year—carelessness, lack of proper instruction, foolhardiness and all the rest. Yes, sir, an oldtimer easily could say, "This is where I came in!"

towards accidents. Normally he has his own record in mind. He is proud to say, if only to himself, that he's never had an accident, never been awarded a 'pilot error.' He doesn't expect to have an accident or to be the cause of one.

"But when we arrived at this school we were unintentionally made to believe that accidents were expected of us. More than once we were given the same old speech, telling us that we were just out of school and would have to watch out for every little thing. Just because we were graduated didn't mean we were accomplished flyers, we were told. Nobody knew this better than we. We didn't feel hot or even lukewarm. We knew we wouldn't break any records. But since they said that we were just out of school and then indirectly told us we would probably mess up here and there, in accordance with all the accident records and knuckle head tricks of former classes, we began to believe them. The men making these speeches inadvertently instilled in our minds the idea that accidents from a group like ours were as plentiful and cheap as dimes in inflation. A good many of us would make mistakes simply because we were just out of school. We tried not to accept the idea but psychologically it was hard not to. We got the feeling that our accident, if we were to have one, would only be one of many and wouldn't stand out to mar the record about which we were all so much concerned."

There, I thought, is a classic example of the negative approach. And isn't it too familiar even now? Don't we still too often grind into the pilot's mind the corrosive idea that some accidents are inevitable? And don't we do this with the very words with which we hope to prevent more accidents? Strange as it seems, we probably do. And how do you help a sad situation like that to change? My student had an answer.

"It might be a good idea," he modestly suggested, "to remind new pilots that they have enough flying time or skill to master the new airplane without too much trouble. Otherwise they wouldn't be here. For that is what the students believe. It fits in with their ideals and doesn't help to break down their morale."

Now who can argue with that? And having thus warmed up, my student then went on to describe with a good deal of glee the pilot we still have with us, that misbegotten candidate for oblivion known to the trade as Mal—Mal Function, that is. And here he was back in 1943, one of the "Boneheads," my student called him, one of those boys, "who fit right into the smouldering roles created by Hollywood. Born to be pilots because of their 'perfect pilot attitude,' which, as Hollywood puts it, is a big happy-go-lucky smile backed up by a little brain. These boys can push stick and rudder with the best of them. When they are looking they can see. And if only they'd keep a constant flow of activity in the vast space between the earphones, their triumph would be complete.

"The popular Air Corps hero has always been a fine stick and rudder man. On the way up to his girl's house he inspects the under sides of bridges. He gives the windows in every town the vibration treatment. He comes in low and our heroine doesn't see him until he rounds the barn. She swoons and he rolls up to a safe altitude before making another pass. All this is part of our hero's life which the movies like to show. But no Hollywood producer could use our hot pilot when his tachometer drops back to zero and he sets 'er down in some pea patch, then reports prop failure. Or the time when his generator really does go out, then his radio and finally his prop. No trouble shooter, our hero! He'll burn it up before finding out the existence, the cause or the remedy of his trouble. When he does happen to make it back to the field, our hot friend will invariably set it down three points on the spot. Landing 'completed,' he breezes down the runway and off the end into the soot. We find him now in that most unorthodox and embarrassing three-point position, one point being the nose of the ship, the crowning touch of all, a taxi accident.

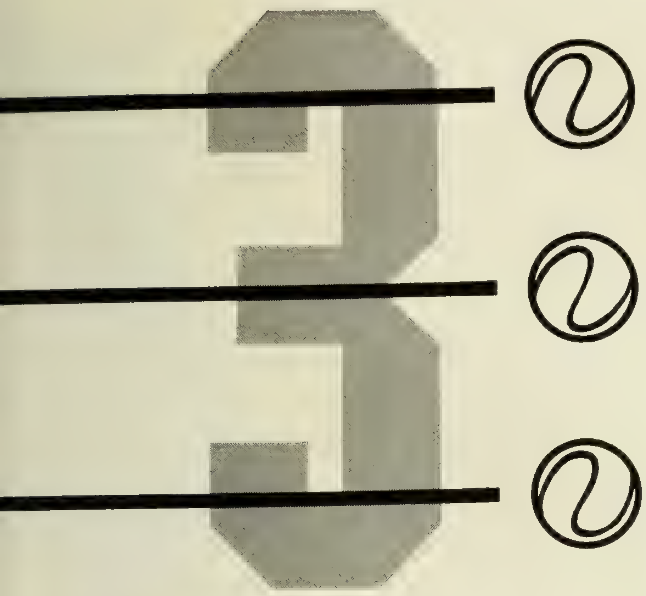
"And these are the accidents, the most unnecessary and uncalled for, that bring the thrusts of the ax wielders at home and in Washington too, still closer and closer to the heart of our training program. . . ."

Stunned, I folded the faded sheets and put them away. It's true, I thought, that we've gotten away in the main from prop failures now. We have flameouts today. And maybe we don't have so much of that good old barnstorming type of carelessness. But isn't this hot shot pilot with us still? And isn't it true about the ax wielders who rise to lop off a few more precious hours of training each time we give them a good excuse, like a pilot who never should have gone into the ground, but who publicly did? Have we really changed our course since Junior found us so far off the beam 'way back in '43? Or isn't it true that we've somehow preserved and perpetuated some of our worst mistakes?

To tell you the truth, I didn't quite know the answer to that when I'd finished this yellowing paper and filed it carefully away. Without even bothering to clean up the mess I'd made or to turn off the light, I walked back into the house. I was badly shook. All else forgotten, I smiled at Sweetie and kissed her a fond goodnight. I kissed her good morning, too—my mind still grinding around the circle laid out the night before. Record Conscious! I moaned to myself as I shaved, gaps in training lead the way to new mistakes. Negative approach! Withdrawing the pilot's right to learn. Inevitable accidents! No accident should seem inevitable and no young pilot should ever be given that excuse! That's a good way to perpetuate our worst mistakes. That's all that is!

By this time I had trimmed my chin right down to the mandible and discovered again that blood is red. That's what comes, I thought, of not keeping your mind on what you're trying to do. Then I went back to wondering again. Was that boy right or was he wrong? Times have certainly changed, I had to admit, but leaping from one fresh cliche to another, have we kept up to date?

I still don't know. Do you? ▲



strikes..... OUT!

Lt. Col. F. S. Spiegel (MC), Office of The Surgeon General

It is neither the intention of the author nor the editors to suggest that any pilot should be "grounded" merely because he has had three—or any specific number—of accidents. On the other hand, it is most necessary to consider the facts in each case in the cold clear light of truth and to act in accordance with the best dictates of conscience. Take the following as a "for instance."

THIS IS THE record of the military career of an Air Force pilot. The facts were obtained from official files including effectiveness reports, investigations, board proceedings, correspondence and other documents contained in the officer's personnel records file. The case history has a moral which might be overlooked if the story were presented in stilted military phraseology and construction. Names, places and dates have been omitted for reasons which will become obvious as the narrative unfolds.

The principal subject was born in the deep South, of average parents, about 30 years ago. His family life and childhood were not unusual. He graduated from high school at the end of World War II and enlisted in the Army Air Forces shortly thereafter.

Medical records reveal that he was involved in a motorcycle accident while an enlisted man and that he had sustained a painfully bruised right knee. Far more seriously, he was unconscious "for over 24 hours," according to the record which is very sketchy and incomplete.

Six months after the accident, in an original "64 examination" for aviation cadet training, there is a notation in the medical history of the accident and injuries. The statement is made that the soldier was knocked momentarily unconscious.

The next physical examination of record was accomplished for pilot rating and commission, approximately a year and a half later. Here no mention is made of an accident, and except for childhood disease, he "denies all else." Review of all subsequent physical examinations and medical records reveals no reference to a motorcycle accident or associated injuries.

While an aviation cadet, this individual was involved in an automobile accident, consisting of a collision with the rear of another car which resulted in injuries to himself and three other persons. Although the cadet had been drinking, he was not considered intoxicated. He stated to the investigating officer that he was traveling no faster than 45 or 50 miles per hour. The investigating highway patrolman estimated his speed at more nearly 70 mph. The base report of investigation of this accident is quoted:

"In view of the lack of conclusive evidence indicating gross negligence on the part of subject airman (sic), it is believed that the doubt must be resolved in favor of subject airman. No more than simple negligence is established by evidence in the case." Result—line of duty, not due to misconduct.

He graduated, was rated a pilot and commissioned a Second Lieutenant shortly after the accident described above. He finished about five weeks after his class. He was assigned to a tactical squadron and was eventually checked out in F-80s. Four months after reporting to his first assignment, he became lost while flying alone. He made a wheels-up landing in a cornfield, due to fuel starvation, as a result of flying the reciprocal of the homer heading given him by the tower. He either neglected or forgot to refer to his magnetic compass and did not use the radio compass.

He appeared before the Flying Evaluation Board as a result of the investigation of the accident. The Board recommended that he be restored to flying status and that he receive additional training until his instrument proficiency met the standards required of F-80 pilots. Pilot error was established as the cause of this accident.

Five months later, the officer was involved in another major aircraft accident, and two months later, another. All three accidents were in F-80s. His second accident consisted of his flying into the target during air-to-air fighter gunnery training, and the third was a night landing in which he landed short of the runway. Each accident caused major damage to his aircraft. Accident Investigation Boards concluded that "pilot error" was a major factor in each instance.

Three months after his third accident, and less than a year and a half after graduation from flying school, he was required to appear before a Flying Evaluation Board upon instructions from Headquarters, USAF. Air Force Regulation 62-4, in effect at that time, directed that all rated pilots who were involved in three major aircraft accidents, were to appear before a Flying Evaluation Board.

The Board was to review each accident, review the pilot's training and experience, consider all evidence and make a recommendation regarding the retention of the individual on flying status. The Board in this instance found that the officer had been involved in three F-80 aircraft accidents in which pilot error had been the major factor. Three flight commanders in his squadron testified, however, that they thought he was qualified to continue flying the F-80.

The Board in its findings noted that this officer was slower than the average pilot in developing judgment and technique in flying this type of aircraft. Consequently, it recommended that the present suspension from flying be removed and that he be restricted to piloting other than jet fighter aircraft.

This recommendation was concurred in by base, subordinate and major command, but Headquarters USAF returned the proceedings for reconvening of the Board. Restricted or limited flying status is contrary to USAF policy. The reconvened Flying Evaluation Board was instructed to comply with the instructions outlined in AFR 62-4, to recommend that the officer either be returned to flying status or that he be suspended. The Board recommended that he be suspended from flying status for lack of flying aptitude. The Central Flying Evaluation Board reviewed the proceedings and concurred in the recommendation.

At about that time, the officer—still a Second Lieutenant—was separated from the service under the provisions of AFR 36-26, reduction in force. During processing for release, he requested retention in the Air Force in an enlisted status. It was determined that the highest grade in which he could be enlisted was that of Corporal. He did not pursue this course any further.

A short time later, he applied for and was appointed in the Air Force Reserve, his orders noting "Pilot on-fly-status." He performed several two-weeks active duty tours and ultimately was assigned to a major command headquarters as a Mobilization Day Assignee. His promotion to First Lieutenant was delayed because of low efficiency index scores.

After a few months, the officer requested reinstatement to flying status and, based upon his anticipation of favorable action by a local Flying Evaluation Board, he made application for recall to extended active duty as a pilot on flying status. His command wrote a strong letter, endorsing the request for recall. During the three-year period that he was in the Reserve Force, he had flown twin engine aircraft, occasionally T-6s, and no jets.

A Flying Evaluation Board was convened and reviewed all accident reports, investigations and board findings, including those of all previous Flying Evaluation Boards. This Board, after due deliberation, recommended that the officer's suspension remain in effect since no new or significant evidence had been submitted which refuted the findings of the board which had suspended him for lack of flying aptitude.

In addition, the Board stated that "the three accidents in which this officer was involved created a pattern indicating momentary lapses of judgment." The Board proceedings never left the base, however, since the convening authority did not approve of the findings. It is stated in the record that the reason for disapproval was due to administrative errors and submission of additional evidence on behalf of the respondent. Nowhere are these administrative errors identified or alluded to.

The Flying Evaluation Board was reconvened. It was reconstituted, consisting of a different panel of officers, except for the recorder. Additional evidence on behalf of the respondent consisted of a witness who had been in the officer's squadron when he experienced his accidents, and a letter from another officer in the squadron. The testimony presented did not appear to dispute the decision of the original suspending Flying Evaluation Board.

From reviewing the verbatim record of the reconvened board, it appears that several members were more impressed by the personality and appearance of the witness than what he had said. The witness was a much decorated, much publicized Air Force ace, who stated he had not had much close contact with the respondent and did not remember many of the particulars of the accidents or subsequent events. He did recall, however, that the officer had been in the old squadron and did remember that there was some question about "people having it in for him."

The Board recommended that the respondent be returned to flying status, since, "in each accident in which he was involved, there were mitigating circumstances over which he had no control, that he possesses inherent flying ability required of a jet fighter pilot and clearly demonstrates that his judgment is normal for an officer of his experience." The proceedings and recommendations of this Board were approved by the convening authority, the same base commander who had disapproved the previous findings.

The officer was returned to flying status within three weeks and was recalled to active duty as a fighter pilot on the same date.

Approximately four years have elapsed since the date of his recall and his demise. He had been checked out in F-89s and had received additional training. The circumstances of his last accident, in which a radar observer was also killed, raised a question regarding the propriety of the reconvened Flying Evaluation Board which returned him to flying status.

Investigation of the accident revealed that the aircraft crashed at a steep angle when in the landing pattern due to a change in the center of gravity of the aircraft and resultant alteration of flight characteristics occasioned by a faulty wing and tiptank fuel valve—creating a wingheavy condition. It was surmised that the pilot was not aware of his problem until he had reduced airspeed since no emergency had been declared. Neither the control tower personnel nor mobile control had been apprised of any inflight trouble. It was pointed out that the pilot may not have been able to cope with the emergency, due to indecision and inability to evaluate the situation and take corrective action immediately.

In reviewing this case history, one gets the impression that the officer fell into the much debated-about "accident-prone" category. The findings of the Flying Evaluation Board, that a pattern indicating momentary lapses of judgment had been demonstrated, would have prevented this accident, if upheld. The recommendation, however, was disapproved for nebulous and questionable reasons. Personalities and emotions have no place in flying business, and even less in the deliberations of Flying Evaluation Boards. Decisions must be dispassionate and based upon fact. Flying safety and mission accomplishment can not be jeopardized or compromised by personal feelings, friendship or sympathy.

There was no necessity for the Air Force to lose a well-trained, experienced radar observer; a half million dollars worth of airplane, and four years of additional training—and the life of this man. ▲

Care to join us for some plain and fancy aerobatics? It's easy and it's fun—as long as you play by the rules—and as long as you know what you're doing and how to come out of the act. There may even be a trick to getting into it. This little doll learned both, but not without long hours of hard practice. The practice must be directed toward specific achievement, as well as based on good sound theory. Bob Hoover has some sound words on the theory. The goals are fairly well outlined by the tactical operation of your type of airplane—or the one you're going to fly. The story is on page 5.

MAL FUNCTION

"Apples fall," so Newton said,
"Where they can find convenient head."

Now aircraft are a different breed,
They fall 'cause pilots do not heed.

Old Mal is just the case in point,
He flies with head that's out of joint.

"The checklist's not for me," he bawls,
As over cockpit edge he crawls.

Because he by-passed Newton's laws,
He's chosen "Mister Most Probable Cause."

•U.S. GOVERNMENT PRINTING OFFICE 441789

4.7505
ys

DECEMBER 1957

FLYING SAFETY

UNITED STATES AIR FORCE

the military flyer

see page one

Lieutenant General Elmer J. Rogers
The Inspector General USAF
Department of the Air Force

Major General Howard G. Bunker
Deputy Inspector General
The Inspector General USAF
Department of the Air Force

Major General Joseph D. Caldara
Director of Flight Safety Research
Norton Air Force Base
California

Colonel Daniel M. Lewis
Supervisor of Flight Safety
Publications

Lieutenant Colonel Ralph R. Springer
Chief, Editorial Branch

•

Editor
Major Vernon R. Stutts

Assistant Editor
Major Francis D. Hessey

Managing Editor
William Johnston

Art Editor
M/Sgt Steven A. Hotch

Production
Major Ben H. Newby

Editorial Assistant
Amelia Askew

Distribution
WO Robert Blum

•

Volume Thirteen
Number Twelve

•

SUBSCRIPTIONS—FLYING SAFETY is available on subscription for $2.50 per year domestic; $3.50 foreign; 25c per copy, through the Superintendent of Documents, Government Printing Office, Washington 25, D. C. Changes in subscription mailings should be sent to the above address. No back copies of the magazines can be furnished. Use of funds for printing this publication has been approved by the Secretary of the Air Force and the Director of the Bureau of the Budget, 18 July 1956. Facts, testimony and conclusions of aircraft accidents printed herein have been extracted from USAF Forms 14, and may not be construed as incriminating under Article 31 of the Uniform Code of Military Justice. All names used in accident stories are fictitious. No payment can be made for manuscripts submitted for publication in the Flying Safety Magazine. Contributions are welcome as are comments and criticism. Address all correspondence to Editor, Flying Safety Magazine, Deputy Inspector General, USAF, Norton Air Force Base, San Bernardino, California. The Editor reserves the right to make any editorial changes in manuscripts which he believes will improve the material without altering the intended meaning. Air Force organizations may reprint articles from FLYING SAFETY without further authorization. Prior to reprinting by non-Air Force organizations, it is requested that the Editor be queried, advising the intended use of material. Such action will insure complete accuracy of material, amended in light of most recent developments. The contents of this magazine are informational and should not be construed as regulations, technical orders or directives unless so stated.

The Editor's View

This was the Year of the Anniversary—at least, for us. Along the way we celebrated the Fiftieth Year of Military Flight. To most of us, it was just another day. A day that was expected. One that had to be. Not that we weren't proud of the fact that we had reached the milestone. We were. Very proud to be a part of the organization that has come so far in so short a space of time. In that time, not only had we given the earth a new dimension—we had stretched man's natural habitat to its very limits.

But it was just another day. Another day in which the Military Flyer of the Air Force did his best to carry out his job in the professional manner befitting the anniversary which, for the most part, was being celebrated for him. Sure. There were spectaculars. There were exhibits of power and derring-do. But they were the symbols. The man behind the symbol was the real hero of the day—the Military Flyer.

Planes have come a long way in the first 50 years. They have grown from 40-mile-an-hour kites to planes that fly hundreds of miles per hour miles above the face of the earth. In January of this year, three B-52s flew around the world in one hop. That is, the men did.

Planes can only do what men have been able to make them do. Men, themselves, haven't changed much since Adam. They haven't changed, that is, except in their ability to get things done. Over the years, flying has been the dream of many men. But it's a long way from a dream to a fact. It has taken a lot more than courage and good intentions to get man off the ground.

For 50 years the Military Flyer has given aviation a goal and a purpose. He has helped develop flight from a gleam in men's eyes to a practical reality. When we first thought of a theme for this issue, *Professional Pilot* was in everyone's mind. With a little thought, it was obvious that the function is more than that.

The Military Flyer is more than an airline pilot (also a professional pilot). He is more than a capable pilot with enough wealth to afford a Twin Beech. He is a person who is also an officer. Compared with other flyers, he is not well paid. He does not always accept the fabulous wages that industry sometimes offers.

He gets real satisfaction from flying with teammates. He is justifiably proud of his exploits in war. Though he may wince and squirm at the moves from assignment to assignment and the inevitable domestic upsets, he at the same time recognizes in himself a bit of the pioneer and has an appreciation of things and places and scenes and peoples in the world that few others enjoy. Most of all, he has a front row seat on the most dramatic travel show in history. Every new discovery in any of the sciences becomes real in the machine he flies. He is the ultimate instrument of survival for our way of life—the Military Flyer.

CONTENTS

Sequence for Safety '58 2
Well Done 5
Flight Safety Awards 6
Slide, Kelly, Slide! 8
Continental Control 11

File Thirteen

Time to wind up the old year and take stock. . . . How did you do on those New Year's resolutions that you made last January? The old zeal for improvement sometimes loses its shine during the passing months. . . . Been poring through the new AFR 60-16 (29 Oct 57). Was startled to find how many changes the Air Force pilot has to learn. No time like now to take a copy of the old and the new and run down the pages to see where you stand. Takes more than the yearly review that we get during instrument exam time anyway. We'll help you with this chore in the next issue. Meantime the reg is in effect and ignorance won't hack it. . . . Double Take Dept: Old Par 34a(3), AFR 60-16, specified that you couldn't get a special VFR clearance if flight visibility was four miles, but you could get one if it got to be less than three. Tricky, what? All cleared up now—see 35a(3). . . . For those who're flying and firing guns, rockets and cannon, it pays to check for cordite plugging static ports. Good item for your walk-around checklist. . . . Neat tip if you're face to face with an emergency landing situation and no smoke, dust or wind tee. Look for the nearest cow. When the wind is strong enough to be a factor, they graze downwind, with their backsides pointing into it. It's a fact! Noticed the same thing with moose and caribou during my romp in Alaska. . . . Merry Xmas to all and to all a good flight!

'til January,

Vernon R Stutts

KEEP CURRENT NEWS NOTES

The first supersonic pitot tube with a larger static chamber and knife edge opening is now ready for production. Its advantages include its ability to reduce "lag," resist vibration and withstand extreme temperature variations.

The first major change in altimeter display dials in 30 years is incorporated in the new "drum pointer" instrument selected for one of our new Century fighters. Only one pointer remains and will indicate "hundreds of feet." "Thousands" and "ten-thousands" will appear on a drum visible through a vertical slot in the dial face. Pilot reading error is thereby eliminated.

An airborne "homing beacon" now enables a fuel-hungry plane to rendezvous with its "cow" from hundreds of miles away. The new unit has been designated the AN/APN-69 and uses a coded interrogating-response feature to insure positive identification.

Designed primarily for navigation, an electronic altimeter, accurate to within 40 feet at sixty-thousand has now been developed by ARDC. It will be useful in aerial reconnaissance work and for other applications where exact altitude above the earth's surface is needed to accomplish a mission.

ARDC has developed a telemetry system by which the picture on a fighter pilot's radar is relayed back to base. By this means the pilot's instructor will be able, through voice communications, to instruct the student from the ground. Even at 40,000 feet you can't get rid of that guy who likes "to read over your shoulder."

Again calling your attention to the renaming of the Holloman Air Development Center—it will henceforth be called the Air Force Missile Development Center. Seems someone noted they really hadn't developed any air since the base was first activated.

The turbojet supersonic target drone developed by Radioplane Company is newest in the line-up of high speed targets against which the effectiveness of guided missiles and defense aircraft may be tested. It has both ground and air launch capabilities and is recoverable by parachute.

Fifteen C-130A Hercules aircraft have been assigned to the 1370th Photo Mapping Group at Palm Beach Air Force Base, Fla. The planes with a cargo section as large as a railroad freight car will be modified to contain the special electronic and photographic equipment needed to bring the world's geography up to date for jet age operations.

A one-month postponement—making December 1 the new effective date—for the control of all airspace above 24,000 feet for air traffic control purposes, was recently announced by CAA.

The P&W J-75 turbojet power plant with afterburner now under production, is designed for speeds of up to Mach 2 and develops well over 15,000 pounds of dry static thrust. Only slightly larger than the J-57, the J-75 is nearly 50 per cent more powerful.

THE COVER

Stevenson B. Canyon, Lieutenant Colonel, USAF, is a professional military pilot, pure and simple. His creator, Milt Caniff, is one of the best friends the Air Force has. Canyon, through the sharp mind and magic pen of Caniff, tells the Air Force story to millions of readers throughout the world. According to Caniff definition, the military pilot, first of all, is dedicated. Dedicated to his job, dedicated to his military teammates, dedicated to his Air Force and dedicated to his country. In addition, he's a pro—all the way. He does his job. He does it when he's supposed to—the way he's supposed to do it.

Sequence fo

Lt. Col. Irvin M. Parsons, Research & Analysis Division, DFSR.

Our boss doesn't believe that a Flying Safety job can be accomplished by sitting at a desk here in sunny California. Sometimes it seems that we hardly get our B-4 bags unpacked long enough to get our dirty shirts laundered. If one of us hasn't visited your base on business in the last year, it is probably more by chance than intent. During this type of Cook's touring, we have tried to "spread the word" about Flying Safety and how to achieve it.

During this traveling, we've also kept our eyes and ears open so that we could bring back the "word." Often our ears got pretty badly bent by comments and remarks about Flying Safety, and a Flying Safety Program. In fact, we noticed that pilots of all ranks thought that our approach was somewhat less than perfect.

His tender feelings somewhat bruised by this attitude, our coach, Major General Caldara, sent in a new play. In September we pulled a neat, double reverse and handed you the ball. We couldn't hand it to all of you directly but we did give it to your representatives at the World Wide Flying Safety Officers Conference. They represented a pretty good cross section from the field. This action came as somewhat of a shock to some of the conferees who had had visions of spending a week lolling around the swimming pool at a lush California resort hotel. They were given the staggering assignment of developing a complete aircraft accident prevention program for the entire Air Force for the year 1958. And they had just five days to do it.

They would never have made it if some of the conferees had not already done a lot of work on the project. As early as April, 1957, representatives of the major commands had met to lay some ground work and to take a searching look at some of the factors affecting the accident prevention business. Their job was to pinpoint the problems and to decide on a plan of attack—a program.

Statistics show us that the frequency of various aircraft accident cause factors is pretty well established. The program—or "plan," if you like—must obviously aim at those causes which occur most often. For ease of production and organization, it was decided to set the program up around the twelve calendar months. The group therefore selected twelve major subject areas.

The pre-planners stated flatly that the program would not work if it were merely a top level directive, or if it were just something for pilots to do. The 1958 program was organized to be used at every command level in the Air Force structure.

The real work on the program started on 9 September, the opening day of the Flying Safety Officers Conference.

People imbued with sincere Flying Safety spirit sometimes go off the deep end for safety. To forestall this, a few basic concepts were emphasized:

Flying Safety is important but it is not to be gained at the expense of the mission. Most of our accidents in 1958 will happen to aircraft now in the inventory and to people who are already through flying school. A program which will produce a better rate in '58 has to deal with the personnel and equipment we now have. The program must accomplish these things at each command level.

- It must develop safety consciousness. You could call this selling safety. Good selling is making a person want something enough to pay for it. We have to pay for safety. You pay for it by wearing a hot, uncomfortable oxygen mask from the time you start to taxi until your mission is completed.

The mechanic pays for it by extra work and added checks to turn out a plane that is really right.

The operations officer pays by the extra time and effort he puts into a plan that can accomplish the mission safely.

It takes real selling to get everyone on the base to the point where he won't accept any product in his work that doesn't bear the trademark "Safety."

- It must develop actions which will spotlight areas of danger. We all know that there are a lot of near misses in the flying business. Unfortunately sometimes we don't miss and then we have accidents. By virtue of these near misses, we oftentimes recognize a hazard and take steps to prevent the accident that might have happened.

We must do things to find these accident potentials so they can be reduced or eliminated. This is the fact-finding function and everyone must get into the act. Statistical studies, accident investigations and operations safety surveys are examples of ways we can do this. But there are more. The Unsatisfactory Report, the Operations Hazard Report, the Near Accident Reports all are examples of how individuals can help.

Flying Safety is not just a magazine nor is it something that individual pilots do. It must be a way of life with each of us interdependent on and assisting the other. If the cycle of information going up or down is broken, the whole process stops. This is a most important point. It is very easy to damn the highly placed, long-

Safety... '58

range planners and blame them for our troubles. Conversely, it is difficult to look for local, close-at-hand solutions.

The conferees at the World Wide meeting came up with twelve practical program segments to be developed. After a closer look perhaps you will agree that they made a good choice.

First, we have responsibilities in three separate areas—the Commander's, the Supervisor's and the Flying Safety Officer's. In practice, each of these individuals is responsible for every one of the other subjects listed.

In the next area, we have listed training, and as a result of proper training we get standardization; and as a result of training and standardization we achieve air discipline.

Subject matters in the third area are weapon systems support, maintenance and facilities — foundations for safe flying.

In the fourth area, education, human factors and the ever-present weather rounded out the list.

Each of these subjects listed involves every one of us every day that we are in the Air Force—either in our responsibility toward preventing accidents or in just plain flying or doing the other jobs we've been assigned to do. No one of them can be shelved to await its chosen month, be it June or December, but all are so important that each can well stand a selected time interval for special additional emphasis. This is the idea behind our program arrangement.

Item one in area one is **Commander's Responsibility.** The commander is the boss but in the Air Force he is more than this. He is involved every day, all day long, throughout the week, during the month and for the whole year in all major decisions

January	**Commander's Responsibility – FSO in the Organization**
February	**Human Factors**
March	**Supervisor**
April	**Weather**
May	**Education**
June	**Air Discipline**
July	**Weapon Systems and Support**
August	**FSO Responsibilities**
September	**Training**
October	**Facilities**
November	**Maintenance**
December	**Standardization**

that must be made and even down to the details about how things are done. Without him we can accomplish little. What must he do? He must plan, he must lead, he must control. He has many responsibilities, to higher headquarters, to lateral headquarters, to his own unit and to the people in it. In his responsibility toward flying safety, he must set his goal; he must organize his flying safety function to most effectively utilize the personnel, materiel and educational resources available to him in such a way that they do him and the organization the most good.

The **Supervisor** is the man who makes a lot of the decisions for the commander. He runs the day-to-day business of the organization and carries out the policies. The supervisor is a key man in all successful operations. He is the man who actually sets the pace; he is the example, and it is through him that we can reach the pilot, the maintenance man, the operations people and the others—including the cook—who affect the safety of flight.

Flying Safety Officer's responsibilities: FSOs are about 1200 strong in the Air Force. They have to radiate their influence, their zeal and their own dedication to everyone else. They are unique in the organization because, like the commander, they have to reach upward, laterally and down, to find and fix the faults that cause aircraft accidents.

Training: In times of peace, a military organization does little else but train for the mission that may be required in war. This training is planned, organized and conducted to turn out a combat-ready Air Force.

Standardization: There are about as many ways of doing any one thing as there are people doing it. This is okay, if we have no limit on time, lives and materiel. But, because of the size and complexity of our organization and the importance of the job we have to do, we in the Air Force must perform in the one best and most efficient way of doing each thing.

This is standardization. It is partly a product of training and it results from a system of checks to see that once people have been taught the best known way, they continue to use it.

Air Discipline: Today's pilot must be precise and disciplined if he is to manage the type of equipment we now have. Every phase of operation today requires more discipline at every level than ever before. This discipline must be part and parcel of command decisions, command supervision, command control and pilot control.

Discipline in flying is instilling the desire—or will—in a pilot, so that he follows the Standard Operating Procedures which have been developed to the absolute maximum of his ability. This is pre-accident discipline and prevents damage to aircraft or injuries to pilots.

Weapon Systems and Support: Weapon systems is a fairly new term intended to describe the end product which we have always wanted: An aircraft and its internal and supporting equipment combined to accomplish the desired mission. It is not something being dealt with only by planners and designers. The weapon systems which are our problems today are the aircraft which are assigned to our operating units.

Maintenance: Every pilot knows that his life constantly rests in the hands of the mechanics who work on his aircraft. Yet many pilots seem peculiarly unwilling to take any action to help improve maintenance. If we can consummate a closer union between the maintainers and the operators in Air Force units, we will have taken a big step toward accident prevention. It is strange that two such vital and dependent functions seem so frequently to be at odds. We should strive for an operations and safety oriented maintenance which will produce not only more, but safer flying hours.

Facilities: Cow pasture military operations were gone before Pearl Harbor. Today, the military aviator has long, wide strips of concrete, with lead-in lights at one end, GCA units alongside and crash barriers at the other end.

A further complex spreads over the rest of the base and along the hundreds of miles of airways between bases. These facilities are not perfect. In 1958 we will fly off much the same runways as we have this year, over the same beacons to the same traffic patterns and be controlled to landing by the same GCAs. Many things can, however, be done to make these facilities more effective.

Education: To many people, "education" and "training" are synonymous. This isn't so. Training is a process to make action almost automatic. Education is the job of getting people to think. In training we try to teach people habits but the flying game requires more than habit. It requires thought and decision. Hence, education, through all possible media.

Human Factors: We have some physiologists, doctors and other specialists at strategic locations in the Air Force who work on areas we usually think of as Human Factors problems. For this part of the program, we have tried to look closer to home.

On each base and all the various command levels we have Chaplains, Doctors, Red Cross workers, Provost Marshals, First Sergeants and others who deal with the inner man and the off duty man. We have tried to come up with a segment that will sell safety to these people who can also affect the on-duty performance of our workers and flyers.

Weather: We can't really do anything about the weather. We have yet to find the forecaster who can actually jack up a ceiling or increase the visibility when we need it. However, we can understand it and use what we know about it wisely. We can prepare ourselves and our equipment properly to meet the weather that we know must come. If it gets bad enough we can run away or around it. Each of these things we now do. We must do them better, more consistently, and with fewer lapses. For both weather personnel and the people who face the weather we need information that will be presented better, accepted more completely and used more wisely.

This is a program for 1958.

The whole program is full of recommended corrective action, which, if thoroughly applied, will reduce the number and severity of our aicraft accidents. Most of these are ideas for 1958; they deal with things in being. The suggestions are things that can be done. They are practical. They will help us to preserve more completely and effectively, the combat capability of the United States Air Force.

Only one job needs still to be done. The program must be sold. I would wager when it hits the "IN" baskets of many commanders, they will say in essence, "Here is a Flying Safety Program; give it to the Flying Safety Officer." This commander might better accomplish his mission if he would give a copy to each of his staff officers and make it required reading. Some will do this. Many a Flying Safety Officer will have to sell the separate ideas to the persons who get the job done. He needs a lot of help to do this. Especially yours. ▲

First Lieutenant

JAMES I. HARRIS

302d Tactical Reconnaissance Sq.

First Lieutenant

FREDERICK C. VOLKER

86th Fighter-Interceptor Sq.

KNOWLEDGE

WELL ★ DONE

TRAINING

LT. JAMES I. HARRIS recently disproved the old adage that lightning never strikes twice in the same place. He also proved that even if it does, a pilot who is well "grounded" need not fear the strike. Let's take a look at the proof.

He was on an ops photo mission in an RF-84F, eighty miles from home when he noticed his utility hydraulic system pressure fluctuate and then drop to zero. He immediately attempted to operate his speed brakes to check for gage malfunction but this proved futile, thus indicating actual system failure. This left him without speed brakes, wheel brakes and flaps—a very poor landing situation indeed.

Harris, remembering well his ground school lessons, lowered his landing gear with the emergency pneumatic system. Enough hydraulic fluid from the gear-up lines thus became available for a one time operation of the landing flaps and speed brakes. When these two systems were extended, he locked both in neutral and came in to land. The RF-84F touched down and Harris held the nosewheel off as long as possible before coming to a safe stop by using the emergency air brakes. Nineteen days later he did it again. Two strikes and two saves. Well Done, Lt. Harris!

LT. FREDERICK C. VOLKER was flying an F-86D near Youngstown, Ohio, when all of his pitot static instruments failed. He was then at 35,000 feet and the weather at Youngstown Airport was 1000 feet overcast, tops at 20,000, with visibility four miles in snow showers. No clear-weather alternate airports were available. Lt. Volker elected to penetrate and land although his altimeter, airspeed indicator and vertical speed indicator were inoperative.

An attempt to vector another aircraft to assist in the letdown failed because of GCI difficulties. By using his wing slats to determine airspeed and his attitude gyro to set up a rate of descent this young pilot began his penetration. At 2600 feet, GCA was able to paint his airplane and assisted in the letdown until visual contact with the ground was made. Lt. Volker then completed a successful landing on a 5000-foot runway with no damage to his airplane.

At the time of this incident, Lt. Volker had only 100 hours in the F-86D and a total of 780 hours in the air. His remarkable display of cool thinking and superb airmanship saved the Air Force and the Air Defense Command one of their first line defensive aircraft. Well Done, Lt. Volker!

FLIGHT SAFETY AWARDS

Shown here are the flying safety leaders of the USAF for the first half of 1957. Many more organizations had fine safety records and the task of making final decisions was not an easy one. The Selection Committee wishes to congratulate all those units who were placed in nomination for the award by their major commands and FLYING SAFETY salutes the winners!

29th Air Division (Def.) Malmstrom AFB, Mont. ADC

During this period, 8,892 accident-free hours were flown by this organization. This remarkable safety record was accomplished largely in jet aircraft under all-weather conditions and in spite of one unit undergoing conversion from one jet aircraft type to another.

• • •

27th Air Division (Def.) Norton AFB, Calif. ADC

Within this organization is the first fighter interceptor squadron to convert to F-102 aircraft. Conducting all weather operations from a five-minute-alert status with a wide variety of equipment, this organization had only one major accident in almost 14,000 hours of flying time. The fact that this one accident was a result of materiel failure attests to the excellent training and supervision within this command.

• • •

Hq Central Air Materiel Area, Europe, AMC

With this reporting period this command has completed three and one-half years of accident-free flying. This unusual record is the result of a persistent training program designed to combat the hazardous conditions of flight encountered in this area. Poor communications, inadequate weather forecasting and landings at airfields under construction are daily hazards for pilots of this command.

• • •

WADC Wright-Patterson AFB, Ohio, ARDC

One destroyed aircraft in almost 12,000 hours of flying is the record of this command in which almost every flight consists of some phase of aircraft or aircraft equipment testing. The accident potential in this type of operation would seem to preclude such an enviable flying safety record. The personnel involved have certainly overcome conditions conducive to a high accident exposure rate.

• • •

Instrument Pilot Instructor School Moody AFB, Ga. ATC

Considering the fact that student pilots were at the controls in 99 per cent of the flights conducted by this organization, the completely accident-free record attained is remarkable. During this period, 184 officers, including 16 foreign officers, were graduated as Instrument Instructor Pilots. (Anyone who has flown in the Southeast will attest to the unusually high frequency of low ceiling, poor visibility and thunderstorm activity in this area.) Ninety-nine hundred hours of flying without accident under the conditions, and with the exacting requirements of the mission, requires that there must have been an extremely flying safety conscious staff.

3560th Pilot Training Wing, Webb AFB, Texas, ATC

In spite of a complete turnover of supervisory personnel during this period and a heavy attrition among the more experienced instructor pilots this organization reduced its accident rate by more than half of that of the previous six months. Three hundred forty-six students were graduated with an average of 105 hours in T-33s.

• • •

5700th AB Gp, Albrook AFB, C. Z. CAIRC

From July, 1955, to the end of the present award period, this organization has remained completely accident-free. During these past four award periods, this outfit furnished aerial logistic support throughout Latin America to Air Attaches, USAF Missions, Air Sections MAAGs and field headquarters of IAGS. All but five of the assigned and attached pilots have primary administrative duties.

• • •

12th Strategic Ftr. Wg. Bergstrom AFB, Texas, TAC

The mission of the jet fighter organization is to conduct strategic fighter operations on a global scale. Despite almost constant deployment status of the units for training purposes these fighter types flew almost 6000 accident-free hours in the F-84Fs.

• • •

802d Air Division, Schilling AFB, Kansas, SAC

"Over nine-million accident-free miles flown" is the proud boast of this command. The sharing of experiences through the operational hazard reporting program has been a major factor in attaining this fine record. Complete safety consciousness is obviously the key to success here.

• • •

376th Bomb. Wg. Barksdale AFB, La. SAC

A strong Standardization Section, together with instructor-pilots who have insisted on strict adherence to all manuals, tech orders, regulations and standard operating procedures, resulted in over 11,000 flying hours without accident in this organization.

• • •

Mountain Home AFB, Idaho, SAC

This organization attributes its ability to fly over 15,000 accident-free hours during this period in large measure to the tenacious efforts of its maintenance personnel. In spite of the low maintenance experience level of personnel assigned, these ground crewmen never failed to provide the aircrews with top quality aircraft.

93d Bomb. Wg. Castle AFB, Calif. SAC

Using the sound approach that "flying safety is everyone's responsibility," this organization flew more than 10,000 hours without an accident during this reporting period. This was the same outfit that sent the B-52s around the world non-stop in 45 hours and 19 minutes, but perhaps even more important is their completely successful job of training combat crews in the B-52 for the whole Air Force.

• • •

10th Air Division (Def.) Elmendorf AFB, Alaska, AAC

A repeat winner, this organization has flown a total of 12,154 accident-free hours during this period. Flying hazards peculiar to this area, together with the variety of aircraft flown and missions assigned, make this record particularly commendable.

• • •

50th Ftr. Bomb. Wg. Toul-Rosiere AB, France, USAFE

Operating jet fighters and trainers over 10,600 hours without accident is an enviable six-months record, even under the best circumstances. This organization made it in spite of home base runway resurfacing and deployment to North Africa for gunnery exercises during the reporting period.

• • •

86th Ftr. Intr. Wg. Landstuhl AB, Germany, USAFE

This all-weather jet organization flew 11,700 hours in the F-86D during this period, lowering its accident rate to less than one-third that of the preceding six months. Its success is attributed to increased emphasis on pilot knowledge of emergency procedures.

• • •

416th Ftr. Bomb. Sq. Chambley AB, France, USAFE

From July, 1955, to June, 1957, or two years and 10,446 hours in the F-86F without an accident! To achieve such a record in Europe is a feat that speaks for itself. The attention to duty and outstanding spirit of teamwork displayed here by officers and airmen have set a mark which will not easily be equalled.

• • •

452d TC Wg. Long Beach Mnpl. Arpt. Calif. AFR

This Wing flew 5,822 hours without either a minor or major aircraft accident. During this period the primary operational task was conversion from bombardment to a troop carrier mission.

• • •

166th Ftr. Intr. Sq. Lockbourne AFB, Ohio. ANG

This Air Guard Unit has not had an accident since October, 1955. Its record is indicative of the outstanding degree of planning and teamwork which this unit applies to all phases of its operations. During this period, 4551 flying hours were logged.

• • •

186th Ftr. Intr. Sq. Great Falls Mnpl. Arpt. Mont. ANG

This air defense mission Air National Guard Squadron with "part-time" pilots was completely accident free during this period. Three months of this six-months time brought weather typical of the great Northern Plains: snow, ice and temperatures down to 30 below. A mark hard to equal or beat!

Clark AFB, Philippine Islands, PACAF

Units of this base have flown missions during adverse weather conditions over mountainous terrain and large open sea areas. Cargo and liaison type aircraft have operated from short, hazardous landing strips of coral, grass sod and packed earth throughout the Philippine Islands. Sixteen types of aircraft flew over 12,000 hours without accident during this period.

• • •

18th Ftr. Bomb. Wg. Kadena AB, Okinawa. PACAF

Even through transition to new aircraft, this Wing maintained a spotless accident and incident record while flying over 7300 hours. All but 420 of these hours were in jet type aircraft and were conducted without a suitable alternate airport. Results reflect creditably on the supervision and training within this organization.

• • •

1608th AT Wg. (Med.) Charleston AFB, So. Car. MATS

This Wing's normal operation includes flights to South America, Europe, North Africa, Saudi Arabia, and throughout the United States. Its crews and aircraft are subjected to practically every type of weather phenomena and operating condition. During this reporting period, sound planning and efficient aircraft operation resulted in a spotless accident record.

• • •

12th Air Rescue Gp, Ramstein AB, Germany, MATS

As in any rescue operation, crews must often be dispatched with a minimum of preflight planning. This, together with all weather operation and hazardous landings in rugged terrain or open sea, presents an ever-present high accident potential. Overcoming these drawbacks to safe operation, this Group has flown almost 15,000 hours without accident during the period from July, 1956, to the end of the present award period.

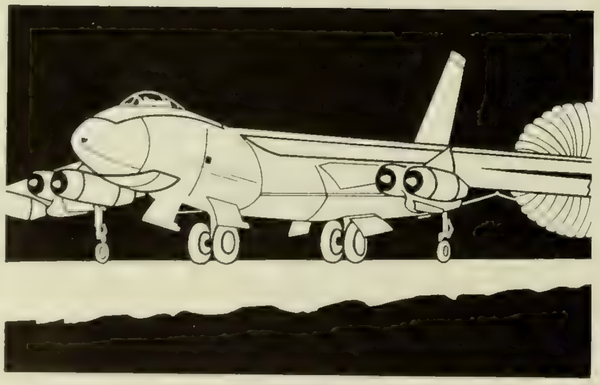
THE SHIELD
of
AIR POWER

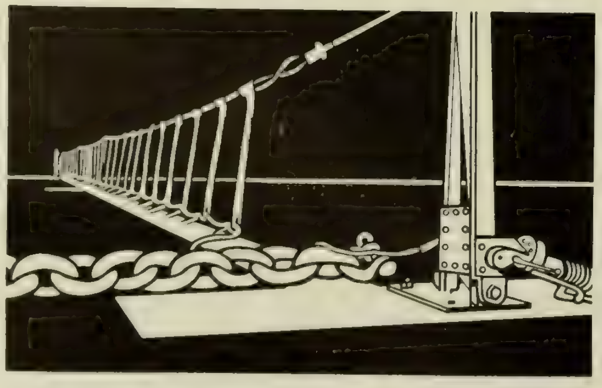
FLYING SAFETY

There's one thing you got to say about a B-47. It sure does slide good! Especially when it's being landed at Goose Bay, Labrador — it's February — the drag chute's been jettisoned — ice on the runway — and 5000 feet to go!

Major Jesse W. Mitchell, 26th Strategic Reconnaissance Wing, Lockbourne AFB, Ohio.

SLIDE, KELLY





"**THIS IS KELLY LEADER**, starting to taxi."

"Roger, two."

"Roger, three."

"Roger, four."

It was February at Goose Bay, Labrador. The base was plowing itself out of one of its paralyzing winter snowstorms and was operational again.

It was 0230 and we were taxiing out with a flight of four B-47s to take off on the last leg of an overseas move. Everything was going along better than expected. The planes had been out in all of the storm but had collected very little ice. We had sprayed them with killfrost to remove a thin spotty layer that had formed. During the last hour a few snowflakes were noticed, but according to the weather briefing this shouldn't amount to much. In fact, it was already showing signs of letting up. The outside temperature read 25 below. We had pre-heated the cockpits and were fairly comfortable in our Arctic clothing.

"Hydraulic pressure normal." This came from Nick, my copilot, as I completed checking the nosewheel steering system and brakes.

The snowplows had done a good job of clearing the taxiway and for once there was not the strange-field problem of "Tower, which way do I go?" The taxiway ahead was the only one open and the snow on each side was piled up three to five feet high. The snowbanks showed up very well in the landing lights but looked uncomfortably close. There was enough room, however, and braking action was good as we taxied out to the active runway.

"Radar checks okay," said Perk, our radar operator. This was welcome news since we had been having trouble with the set.

As we taxied onto the runway the snowbanks on each side really showed up. They must have been at least six feet high and were just off the edges. Although the runway was 300 feet wide and there was plenty of room between banks, they looked mighty close—to us, fresh from the desert southwest.

The other three B-47s were already in position and we took off as scheduled. "Kelly two" and "Kelly three" followed us as scheduled, but "Kelly four" aborted after rolling about 1000 feet down the runway. He notified the

tower that he had reset an alternator and would try again. This time he was about 3000 feet down the runway when he aborted with the same malfunction. He deployed his brake chute this time and stopped without difficulty. After turning around, he jettisoned his chute and went back to the ramp. He asked the tower to send an electrician, a new brake chute and the de-icing equipment. When the tower operator asked why he needed killfrost, he replied in a you-won't-believe-it tone of voice, "The wings are covered with a layer of heavy frost. It formed as we were taxiing back to the ramp."

The rest of us were well on our way and it looked as if we would be in "Merry Ole England" in six hours or less. Just about the time we were to check out with Goose Traffic Control, we received a message to return to Goose. The weather at destination had taken an unanticipated turn for the worse and we were to return immediately. We did the 180, as requested. We were too heavy to land, however, so we got clearance from Goose control to descend since we could burn off the fuel faster at lower altitudes. We were stacked from 15,000 feet up.

After three hours we were down to normal landing weight and requested landing instructions. We were told to land on runway 35 which was 90 degrees from the direction we had taken off. The wind was reported at 15 knots from 15 degrees, temperature 27 below, ceiling 2500 feet and visibility eight miles.

Goose control gave us approach times and we were to land in reverse order from our takeoff sequence. The first airplane was picked up by GCA and landed. The runway we were landing on did not have any taxiways cleared to it, so after landing, "Kelly three" had to turn around and taxi back down the active to its intersection with the other runway. He then taxied up this runway to the one open taxiway and back to the ramp. This took more time than anticipated. In addition, the alert pickup truck had trouble locating the jettisoned chute. These two factors caused "Kelly two's" approach time to be 15 minutes later than expected.

"Kelly two" then made his GCA and landed. He reported that braking action was poor but did not have any trouble stopping. He jettisoned his brake chute and was turning around on the runway when he called the tower and stated that he had cut all engines. He had started sliding in the turn and the brakes wouldn't hold, so he cut the engines to keep from going off the runway.

"Tower, this is Kelly two, I'll have to have a power unit to start engines."

"Roger, stand by."

Twenty five minutes later, "Kelly two" was clear of the runway and we were told to begin our approach.

Just before reaching the high cone of Goose Radio Range, the approach controller advised us that the wind had shifted and was 45 degrees off either of the open runways. We had our choice for landing. I chose the one we had used for takeoff because it was 11,000 feet long.

We reported over the station and GCA picked us up in the penetration turn. We continued around the pattern and broke out of the overcast at 2000 feet approximately six miles out. Everything looked fine. Visibility was good and the runway lights were straight ahead.

Our touchdown was about 1000 feet down the runway which is a little shorter than usual.

I called, "Brake chute now!"

A couple of seconds later Nick said, "It's a good one." I felt the pull of the chute at the same time Nick called out and I answered by saying, "Cutting 1, 2, 5 and 6." This was SOP and I knew that Nick would be looking back to see if the chute blossomed correctly and also to see if it was staying with us.

This time he didn't have to tell me it was staying because just as I cut 1, 2, 5 and 6, I noticed that we were being pulled to the side of the runway by the crosswind acting on the chute. Nosewheel steering didn't help correct the drift and that six-foot wall of snow on the left looked big and close.

I called over interphone, "Jettison the brake chute!" I pulled my chute jettison handle and I suppose Nick pulled his, too. The sideways travel stopped and with the use of rudder I got back in the middle of the runway. Then I pushed on the brake pedals.

Nothing happened!

"How is our hydraulic pressure?"

"It's normal."

One thing I'll say about a B-47, it sure does slide good.

That is what we were doing at a speed of 100 knots. I sure wished for some reversible props.

"Turn off the anti-skid, maybe locking the brakes will help," was a suggestion from Nick. I did, but this didn't help. With anti-skid ON or OFF we charged straight as an arrow down the runway toward that wall of snow at the end.

"Crew, prepare for crash landing! We may run off the end of the runway."

"Tower, this is Kelly, we may slide off the end of the runway!"

All this happened and we still had 5000 feet to go. We were slowing down but still indicating 80 knots. The green lights at the end of the runway were showing up very plainly. I thought, "Wouldn't it be nice if we had a runway barrier." I said, "Nick, I'll cut the engines and switches just before we go off the end."

"We're down to 50 now. How much runway is left?" This came from Perk, sitting in the nose.

"Twenty Five hundred feet, I guess."

I wondered if the snowbank at the end was very hard. It probably was since it was so cold. They say this gear is well stressed. I remembered from Wichita the story about a student who made a hard landing and on the first bounce the outboard engines fell off and on the second, the inboards and the outriggers went. On the third he dragged one wing and groundlooped. The main gear held up throughout all this and afterwards, when checked, operated perfectly.

We now had about 1000 feet left and for the first time it looked like this sliding monster might stop before running off the end.

"Hey, Perk, if we do go off the end, it won't be very hard."

We started hitting rough places in the runway and for the first time I felt the brakes taking hold. We were barely moving. Now we had stopped. The green lights were actually behind us but we were still on the runup area off the end of the runway.

Just lucky, I guess.

If we had landed the normal distance down the runway, or if the brake chute had malfunctioned, this story would have ended differently—to say the least. After several sighs of relief that we hadn't bent this B-47 up, we began thinking of possible reasons why we had experienced the trouble we did. Was there some factor that we had failed to consider in the operation of our B-47 from snow-covered runways?

After considering the events leading up to our landing, these three questions came to mind:

- How did "Kelly Four" get frost at 25° ?
- How can a runway get slick at −27° ?
- What can be done to prevent B-47s from running off the ends of runways because of braking malfunction?

The answer to the first question is this: The B-47's exhaust gas strikes the ground about 15 to 25 feet behind the tailpipe. This melts the top of snow or ice behind the airplane. While taxiing down the runway with the tail into the wind, water vapor caused by jet blast melting the ice and snow, blew over the cold wing and immediately condensed and froze in the form of frost or rime ice. It looked like regular frost.

The answer to the second question goes like this: Remember "Kelly Four?" He taxied up and down the runway a total of four times. "Kelly Two" and "Kelly Three" taxied down this same runway just prior to our landing. The jet blast, directed toward the runway, had caused the top of the compacted layer of snow to melt and then freeze again in the form of clear, slick ice. Naturally, this makes good sliding. From where we jettisoned our brake chute, to the point where we stopped measured 8450 feet.

Question number three doesn't have a satisfactory answer. New charts have been published for computing landing roll on wet and snow-covered runways. However, charts for landing on glaze ice do not exist!

The Air Force has recognized a need for additional safety factors in stopping high speed jets. For fighters, the MA-1 Runway Overrun Barrier, which is the familiar chain type, has prevented many potential losses. This barrier is not effective on any icy runway because of the absence of friction generated when the chains slide over the surface. During a 13-month period ending in October, 1956, ARDC estimated a 78 million dollar saving in aircraft through use of the chain type barrier. During this period the barrier was used 327 times. Numerous instances of jet bombers overrunning the runway while landing has pointed up the need for a bomber barrier. One suitable for bomber use is now being developed.

The maximum stopping force obtainable with the chain barrier is about 40,000 pounds. For a B-47, B-52 or even an F-102, this is not enough stopping force for practical use. A force of 110,000 to 115,000 pounds is needed. A contract has been let for design, manufacture and testing of a barrier adequate to provide this force. Probably a linear friction type brake will be used. This could be something like an oversized brake drum which has been straightened out and placed along the side of the runway. A sliding brake shoe would then be attached to the aircraft barrier engaging system. The unit will be designed to stop the aircraft in 1000 feet or less. Testing of this barrier will begin at Edwards Air Force Base soon and is scheduled for completion this month.

Reverse engine thrust has been considered as an answer to this problem. This system has proved as effective as reversing propellers on conventional engines. However, there are two drawbacks. One is weight. It takes 300 pounds of extra weight per engine to install thrust reversers. The second drawback is cost. For the B-47, this is in excess of $90,000.

Development of better materials for more efficient brakes and for better traction in tires is continuing. At this time there is little hope for substantially better materials than those we have.

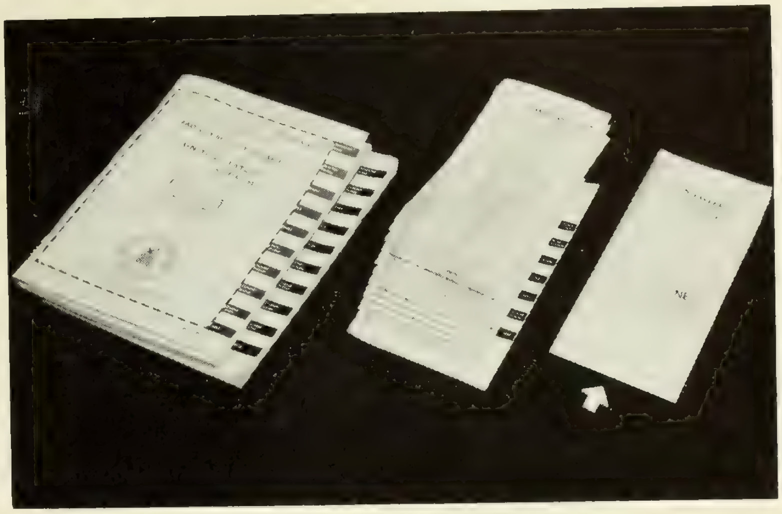
About the only remaining solution to this problem is to lengthen our runways. Without brakes, flaps or a brake chute, a runway approximately 23,000 feet in length is needed for a 115,000-pound, B-47 to roll to a stop. The enormous cost and time needed to complete a project of this size makes this solution impracticable. Even if it was practicable many runways could not be extended because of terrain features.

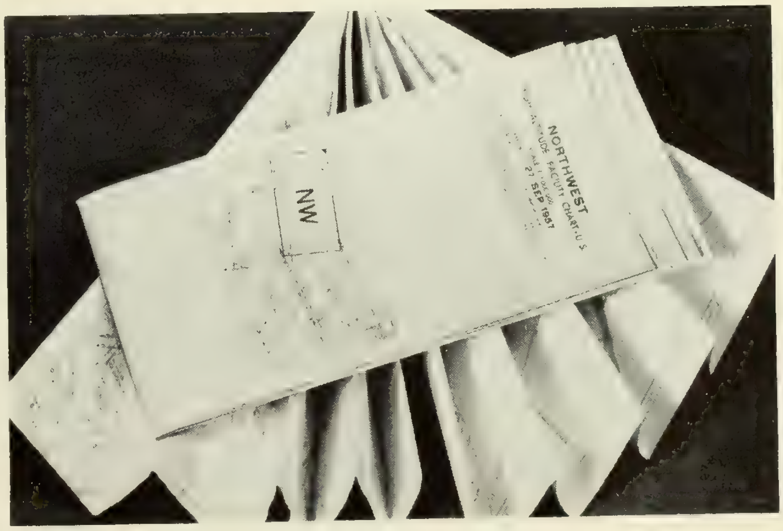
After consideration of all factors mentioned, it appears that the runway barrier is our best bet.

Let's hope that the near future will bring barriers for all Air Force runways. They will provide that extra margin of safety we need. Even with the safety and security of runway barriers, constant vigilance and alertness will continue to be our guide in our effort to reduce landing accidents. ▲

continental control

Charles J. Moebus, ACIC





The top photo shows the new High Altitude Facility Charts, two for the whole country. In the bottom pic you see how the Fac Chart boys have boiled 'em down in two steps to do the job.

ontrol of air traffic in the United States has undergone a drastic change in the past few weeks. ntil recently, this control, geared to raffic of a pre-World War II vintage, as been inadequate to fulfill the reuirements of the tremendous increase n both military and civil aviation ctivity. The powers that be have herefore developed a plan designed o relieve the congested air traffic ituation.

This plan has not come about overight. It took years in the making nd still cannot be considered complete because of all the "unknowns" which will become apparent as a result of actual operations. It takes ime to find out how you human missiles get about. In order to open the gates of this plan, it was decided first o improve control of high altitude traffic through new procedures, observe the fruits of this control, and apply the experience to lower altitudes at a later date.

The first step in improving control was to designate all airspace above 24,000 feet as a special area called the "Continental Control Area." The airway structure 27,000 feet and above was simplified and geared to high performance type aircraft operating at these altitudes. The control area is to be eventually subdivided into sectors and direct pilot-to-controller communications within each of these sectors effected. No more red tape!

It was also decided to put this plan into effect gradually as all the details could not be worked out on paper because of the variety of operations involved. Therefore, effective 1 December 1957, pilots flying 27,000 feet and above are no longer required to bother with the low altitude federal airways system. However, certain of the navigational facilities (LF/MF, VOR, TACAN and VORTAC) used in conjunction with this airways system are necessary and have been designated as high altitude facilities.

The high flying pilot is now required to file his route of flight via these designated high altitude facilities, all of which are now compulsory reporting points. For ease of flight planning, a "preferred" route structure greatly simplified in comparison with the low altitude airways system was established. This route structure was based upon studies of previous traffic flow conditions. To give you—the pilot—some leeway in choosing your route, it was decided that you could fly off these recommended routes provided the route of flight was filed via any high altitude facility not more than 300 nautical miles apart.

In order to accurately keep track of the location of the aircraft (in the air, of course), adequate air/ground communications channels are necessary.

Although we cannot discount the

use of radar in pinpointing locations, direct pilot-to-controller communications is considered the ideal method with which to accomplish this. All of this requires a tremendous amount of manpower and equipment which to date has not been made available. It is expected, however, that—in due time — complete pilot-to-controller communications facilities will be available and specific communications frequencies (discrete frequencies) established for each sector.

Details of the operating procedures? Sure, we've got these too! They can be found set out in legal jargon on the panel of the High Altitude Facility Chart and in the Special Notices section of the bound RFC.

Before the high altitude plan could be put into effect, some kind of chart containing the high altitude information had to be made available. It was decided that the present bound RFC publications of which most of you are familiar could not be modified to include the additional high altitude routes and allied information. Representatives of Headquarters USAF, the Civil Aeronautics Administration and Major Air Commands, therefore agreed that a sheet type high altitude facility chart would be best in giving you the Big Picture.

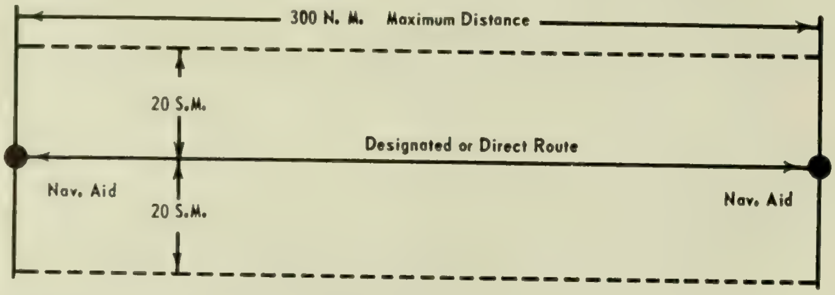
This newly developed High Altitude Facility Chart U.S. consists of four charts (printed back to back on two sheets of paper). These charts have been given a special fold adaptable for use in the close confines of the cockpit of high performance type aircraft. The design includes a "partial margin" type format, i.e., the border of the chart on two edges is eliminated so that the four charts may be readily joined together to form a wall planning chart. It was decided that initially these charts would contain a minimum amount of essential information — only designated high altitude navigation aids would be shown. However, there is a certain conglomeration of data that simply can not be eliminated. Mileages, magnetic bearings, reporting points, airfields, control areas, ADIZ boundaries and restricted areas basically complete the list of *minimum* information needed by the pilot.

Only airfields equipped for use by jet aircraft are shown. For the benefit of pilots able to draw a straight line, a compass rose is placed at each facility to assist in computing bearings for flights off preferred established routes.

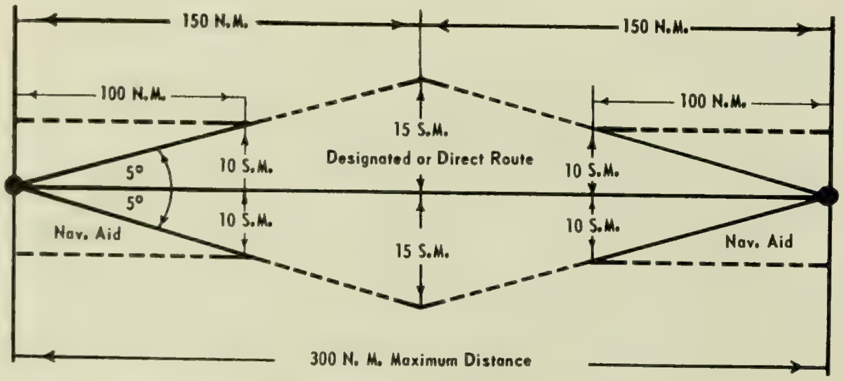
Charts were distributed about the middle of October in order to allow a period of time for pilots to become familiar with the high altitude chart. It is not intended that this high altitude chart will replace the present bound or sheet type RFC. Every effort, however, is being made to eliminate the need for the low altitude RFC in jet aircraft.

Perhaps someday the ultimate goal of complete NAVAID coverage in one little package may become a reality. ▲

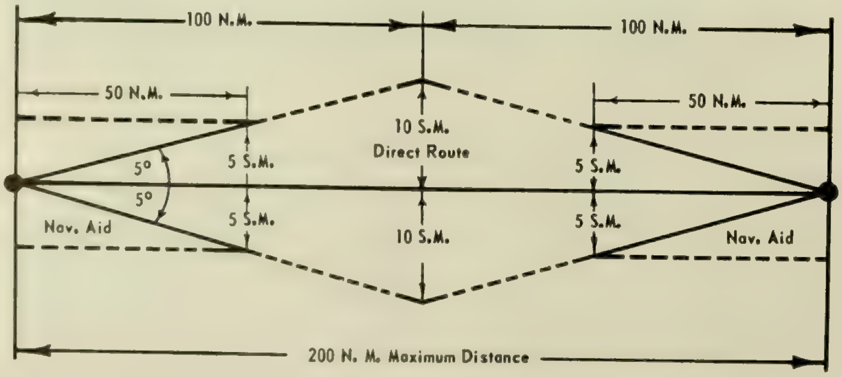
Route width to be protected by Air Traffic Control—Lateral separation between aircraft operating IFR within the continental control area will be provided by air traffic control on the basis that aircraft will remain within the following route widths:



For operation at and above 41,000 msl—The airspace to be protected along any route will be 20 statute miles on either side of the route.



For operation from 27,000 through 40,000 msl—The airspace to be protected along any route will be 10 statute miles on either side of the route beginning over the navigation aid to a distance of 100 nautical miles from the aid, then increasing in width on the basis of a five-degree angle from the route as measured at the navigational aid, to 15 statute miles on either side of the route at maximum distance of 150 nautical miles from the aid.



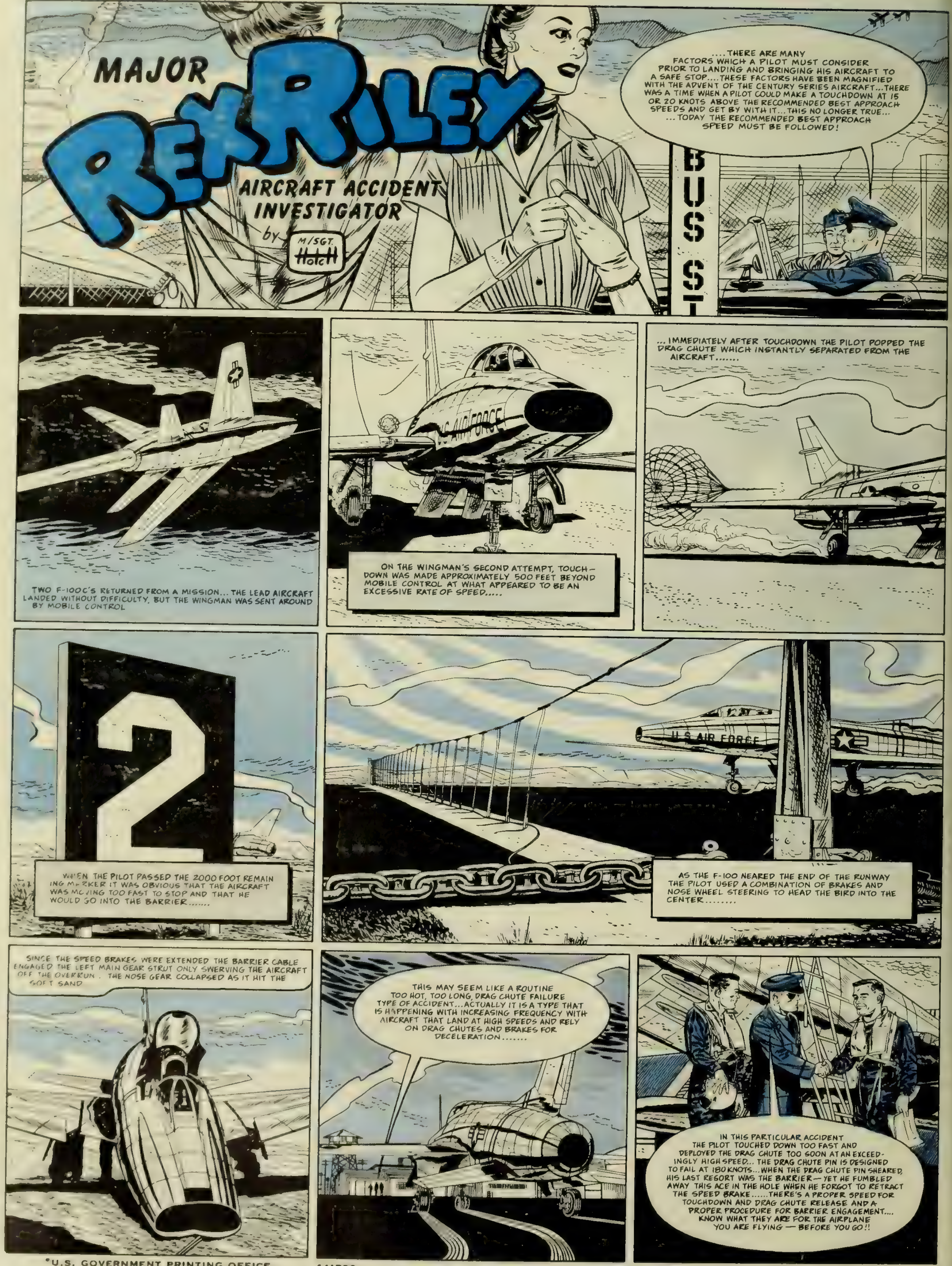
For direct (off-airway) operation 24,000 through 26,000 msl—The airspace to be protected along a direct route between navigational aids will be five statute miles on either side of the route beginning over the navigational aid to a distance of 50 nautical miles from the aid, then increasing in width on the basis of a five-degree angle from the route as measured at the navigational aid, to 10 statute miles on either side of the route, at the maximum distance of 100 nautical miles from the navigational aid.

checklist for the holidays

If you can answer all questions below correctly, we know that your holidays will be happier. Merry Christmas!

• • •

- Did you start too late this year to get the job done?
- Did you issue the proper orders in time to get results?
- Have you "fallen" for the slipshod way of doing your work?
- Are you insisting on good air and ground discipline?
- Has your boss delegated you enough authority?
- Are trivial matters "snowballing" on you; keeping you away from the prime mission?
- Have you got your mind on the proper goal?
- Have you any regrets about the way you've handled the job?


MAJOR REX RILEY
AIRCRAFT ACCIDENT INVESTIGATOR
by M/SGT. Holcomb
....THERE ARE MANY FACTORS WHICH A PILOT MUST CONSIDER PRIOR TO LANDING AND BRINGING HIS AIRCRAFT TO A SAFE STOP....THESE FACTORS HAVE BEEN MAGNIFIED WITH THE ADVENT OF THE CENTURY SERIES AIRCRAFT...THERE WAS A TIME WHEN A PILOT COULD MAKE A TOUCHDOWN AT 15 OR 20 KNOTS ABOVE THE RECOMMENDED BEST APPROACH SPEEDS AND GET BY WITH IT...THIS NO LONGER TRUE... ...TODAY THE RECOMMENDED BEST APPROACH SPEED MUST BE FOLLOWED!
BUS ST
TWO F-100C'S RETURNED FROM A MISSION... THE LEAD AIRCRAFT LANDED WITHOUT DIFFICULTY, BUT THE WINGMAN WAS SENT AROUND BY MOBILE CONTROL
U.S. AIR FORCE
ON THE WINGMAN'S SECOND ATTEMPT, TOUCHDOWN WAS MADE APPROXIMATELY 500 FEET BEYOND MOBILE CONTROL AT WHAT APPEARED TO BE AN EXCESSIVE RATE OF SPEED.....
...IMMEDIATELY AFTER TOUCHDOWN THE PILOT POPPED THE DRAG CHUTE WHICH INSTANTLY SEPARATED FROM THE AIRCRAFT.......
2
WHEN THE PILOT PASSED THE 2000 FOOT REMAINING MARKER IT WAS OBVIOUS THAT THE AIRCRAFT WAS MOVING TOO FAST TO STOP AND THAT HE WOULD GO INTO THE BARRIER.......
U.S. AIR FORCE
AS THE F-100 NEARED THE END OF THE RUNWAY THE PILOT USED A COMBINATION OF BRAKES AND NOSE WHEEL STEERING TO HEAD THE BIRD INTO THE CENTER........
SINCE THE SPEED BRAKES WERE EXTENDED THE BARRIER CABLE ENGAGED THE LEFT MAIN GEAR STRUT ONLY SWERVING THE AIRCRAFT OFF THE OVERRUN. THE NOSE GEAR COLLAPSED AS IT HIT THE SOFT SAND
THIS MAY SEEM LIKE A ROUTINE TOO HOT, TOO LONG, DRAG CHUTE FAILURE TYPE OF ACCIDENT...ACTUALLY IT IS A TYPE THAT IS HAPPENING WITH INCREASING FREQUENCY WITH AIRCRAFT THAT LAND AT HIGH SPEEDS AND RELY ON DRAG CHUTES AND BRAKES FOR DECELERATION.......
IN THIS PARTICULAR ACCIDENT THE PILOT TOUCHED DOWN TOO FAST AND DEPLOYED THE DRAG CHUTE TOO SOON AT AN EXCEEDINGLY HIGH SPEED... THE DRAG CHUTE PIN IS DESIGNED TO FAIL AT 180 KNOTS...WHEN THE DRAG CHUTE PIN SHEARED, HIS LAST RESORT WAS THE BARRIER—YET HE FUMBLED AWAY THIS ACE IN THE HOLE WHEN HE FORGOT TO RETRACT THE SPEED BRAKE......THERE'S A PROPER SPEED FOR TOUCHDOWN AND DRAG CHUTE RELEASE AND A PROPER PROCEDURE FOR BARRIER ENGAGEMENT.... KNOW WHAT THEY ARE FOR THE AIRPLANE YOU ARE FLYING — BEFORE YOU GO!!

*U.S. GOVERNMENT PRINTING OFFICE 441790

UNIVERSITY OF ILLINOIS-URBANA
3 0112 084233771